IMP. BUR. ENTOM.
— LIBRARY —
No. 2999.

TRANSACTIONS

OF THE

AMERICAN

ENTOMOLOGICAL SOCIETY

VOLUME L

HALL OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

LOGAN SQUARE

1925

Digitized by the Internet Archive
in 2025

https://archive.org/details/transactions-of-the-american-entomological-society_1924-1925_50

LIST OF PAPERS

Blaisdell (Frank E., Sr.)

Studies in the Melyridae (Coleoptera). Number Four 313

(Issued January 12, 1925.)

Bueno (J. R. de la Torre)

The Nearctic Rhagoveliae (Heteroptera; Veliidae) . 243

(Issued September 10, 1924.)

Calvert (Philip P.)

The Generic Characters and the Species of Philogenia Selys (Odonata: Agrionidae) 1

(Issued May 29, 1924.)

Coolidge (Karl R.)

Life History Studies of Some Californian Rhopalocera (Lepidoptera) 319

(Issued January 12, 1925.)

Cresson (E. T., Jr.)

Studies in the Dipterous Family Ortalidae, with Descriptions of New Species, mostly from North America 225

(Issued September 10, 1924.)

Davidson (W. M.)

Observations and Experiments on the Dispersion of the Convergent Lady-Beetle (Hippodamia convergens Guérin) in California 163

(Issued September 10, 1924.)

Hebard (Morgan)

Studies in the Acrididae of Panama (Orthoptera) . . 75

(Issued July 21, 1924.)

The Group Scyllinae (Orthoptera, Acrididae, Acridinae) as Found in North America, with Records and Data on its Occurrence in the United States . . 157

(Issued September 10, 1924.)

Studies in Japanese Acrididae (Orthoptera) . . . 209
(Issued September 10, 1924.)

A Revision of the Genus Taeniopoda (Orthoptera, Acrididae, Cyrtacanthacrinae). 253
(Issued January 6, 1925.)

LAMB (LAURA)
A Tabular Account of the Differences between the Earlier Instars of Pantala flavescens (Odonata: Libellulidae). 289
(Issued January 12, 1925.)

SKINNER (HENRY) AND WILLIAMS (R. C., JR.)
On the Male Genitalia of the Hesperiidae of North America. Paper IV. 57
(Issued June 16, 1924.)

On the Male Genitalia of the Hesperiidae of North America. Paper V. 141
(Issued July 21, 1924.)

On the Male Genitalia of the Hesperiidae of North America. Paper VI. 177
(Issued September 10, 1924.)

VAN DUZEE (M. C.)
The Dipterous Genus Syntormon in North America (Dolichopodidae) 275
(Issued January 6, 1925.)

WILLIAMS (R. C., JR.)
(See SKINNER)

INDEX

The names of new genera and of new species are followed by the name of the author.

PAGE

Aaroni (Poanes)..... 60
abdominalis (Olla)..... 168
Abracris (see obliqua)
Acanthalobus (see bispinosus and japonicus)
accius (Lerema)..... 73
aciculata (Otumba) *Hebard* ... **84**
Acrida (see nasuta and turrita)
Acridae 211
Acrididae.....75, 209
Acridinae.....93, 211
Acridium (see coxale, intricatum, japonicum, paranense and peregrinum)
Acrosticta (see rufiventris, scrobricularis and similis)
Acrydi 210
Acrydiinae.....79, 210
Acrydium (see aeneo-oculatum, bicolor, bispinosum, flavolineatum, japonicum, latreillei and longipenne)
acuminata (Paulinia)..... 100
acuminatum (Acrydium)..... 100
aenea (Chaetopsis)..... 241
aeneo-oculata (Vilerna) 131, 132
aeneo-oculatum (Acrydium).... 131
Aeolacris..... 76
Aeschna..... 289
aetna (Thymelicus)..... 154
affine (Syntormon)....277, 279, 280
afranius (Thanaos)..... 198
Agesander..... 76
agricola (Augiades).....142, 143
Agrion (see pulchellum)
Agrionidae..... 1
Aidemona (see azteca)
Aiolopi..... 214
Aiolopus (see tamulus)
akitana (Oedipoda)..... 209
alabamae (Atrytone)..... 67
albitarsis (Homalocephala)..... 235

PAGE

alcina (Polites)..... 153
Aleuae..... 126
alliaceus (Gryllus)..... 213
alliaceus (Mecostethus)....212, 213
Allopodagrion..... 3
Allotettix (see peruvianus)
amazonus (Paurotarsus)..... 92
Amblytropidia (see ferruginosa and insignis)
Amblytropidiae..... 94
Ampelophilus *Hebard*.....125, **127**
(see also apicalis, geniculatus, meridionalis, olivaceus, truncatus and viridulus)
Anacampta..... 234
(see also latiuscula and pyrrhocephala)
anacapensis (Listrus)..... 316
angustata (Chaetopsis)..... 238
angustipes (Rhagovelia)..... 245
Anniceris.....76, 125, 126, 127
(see also apicalis, costaricensis, geniculatus, meridionalis, nigrinervis, olivaceus, truncatus and viridulus)
annulata (Trilophidia)..... 216
annulicornis (Phaeoparia)..... 129
antennata (Gonista)..... 211
antennatus (Paratettix).....88, 90
apennina (Pamphila)..... 184
Aphis (see gossypii)
apicalis (Ampelophilus)..... 127
apicalis (Anniceris)..... 127
apicalis (Psairoptera)..... 236
Apodemia (see mormo and virgulti)
Aptoceras..... 76
Archilestes (see grandis)
arctatus (Stenobothrus).....94, 96
arctoa (Rhagovelia) *Bueno* 243, 246, **250**
Arcyptera (see fusca)

Argia (see medullaris)
Argiacris 102
(see also tricristata)
Aristia 130
(see also depressicornis)
armata (Rhagovelia) 245
armatulus (Listropsis) *Blaisdell* **316**
Arnilia 116
arogos (Atrytone) 64
arpa (Atrytone) 65
aryxna (Megathymus) 204, 205
assiniboia (Pamphila) 186
Atalopedes 141
(see also campestris and huroni)
Atractomorpha (see bedeli)
Atrytone (see alabamae, arogos, arpa, bimacula, conspicua, delaware, dion, dukesi, immaculatus, kumskaka, lagus, logan, palatka, pilatka, vestris, and zabulon)
Atrytonopsis 154
(see also cestus, deva, edwardsi, hianna, loammi, lunus, margarita, pittacus, python and vierecki)
attalus (Erynnis) 178
attalus (Pamphila) 178
Augiades 141, 142
(see also agricola, milo, morrisoni, napa, nemorum, pratincola, scudderi, snowi, sylvanoides, verus, yreka and yuma)
augusti (Philogenia) *Calvert* 12, 16, 19, **42**
aurantia (Taeniopoda) 269, 271
auricornis (Rhomalea) 263
auricornis (Taeniopoda) 253, 255, 262, 266
ausonius (Thanaos) 196
australis (Locusta) 215
azteca (Aidemona) 136
azteca (Platyphyma) 136
aztecus (Paratettix) 87
aztecus (Telmatettix) 86
aztecus (Tettix) 87

Balloui (Orphulella) 94
balloui (Orphulina) 94
baracoa (Polites) 154
barretti (Neotettix) 90
barretti (Ochetotettix) 90
basilaris (Rivellia) 225
Batrachideae 91
bedeli (Atractomorpha) 217
berenice (Philogenia) 3, 13, 16, 19, 33
bicolor (Acridium) 211
bicolor (Gonista) 211
bicolor (Gryllus) 213
bicolor (Inusia) 119
bicolor (Opsomala) 211
bicolor (Stauroderus) 213
bicristata (Taeniopoda) 253, 256, 273
bimacula (Atrytone) 65, 67
bimaculata (Psairoptera) 235
biolleyi (Leuconotus) 97
biolleyi (Munatia) 100
bisinuatum (Syntormon) *Van Duzee* 277, 279, **282**
bispinosum (Acrydium) 210
bispinosus (Acanthalobus) 210
biumbrata (Psairoptera) 235
boucardi (Linoceratium) 95
brettoides (Hylephila) 319
brettoides (Polites) 147
brettus (Polites) 147
brevicornis (Gryllus) 93
brevicornis (Metaleptea) 93
brevicornis (Truxalis) 93
brevifasciata (Rivellia) 229
brizo (Thanaos) 194, 195, 196
brunneri (Pseudostauronotus) .. 99
Bucephalacris 125
bulenta (Problema) 62
burgessi (Thanaos) 194, 195
burmeisteri (Taeniopoda) ...256, 257
byssus (Problema) 62

Cabelus (Pamphila) 182
Caletes 76
calida (Scyllina) 160
calidus (Plectrotettix) 159, 160
californica (Pamphila) 190, 193
callidus (Thanaos) 195, 198

Callophrys (see dumetorum and perplexa)
campestris (Atalopedes) 141
camurus (Platythorus) 79
cana (Ceroxys) 231
cana (Melieria) 231
cana (Ortalis) 230, 231
carbona (Tetanops) 234, 235
Carcharacris 212
carrillica (Philogenia) 3, 12, 17, 45
cassandra (Philogenia) 2, 5, 13, 15, 17, 22, 44
catena (Pamphila) 184, 186
caternaultii (Elaeochlora) 101
Catia (see druryi, egeremet and otho)
caudata (Tettix) 89
caudatus (Micronotus) 89
centurio (Gryllus) 262, 263, 265, 267
centurio (Locusta) 262, 265
centurio (Rhomalea) 256, 262
centurio (Taeniopoda) 254, 255, 258, 262, 263, 265, 267, 268
cerciata (Eumastax) 92
cernes (Polites) 152
Ceroxys (see cana, obscuricornis, ochricornis and similis)
cestus (Atrytonopsis) 71
Chaetopsis (see aenea, angustata, magna and massyla)
championi (Philogenia) 3, 5, 12, 16, 19, 44
chipmani (Inusia) 119
Chiriquia (see serrata)
chirripa (Cora) 50
chocoensis (Opshomala) 117
chocoensis (Taeniophora) ... 107, 109
Choranthus 61
(see also haitensis, radians and vitellius)
Chromacres 103
Chromacris (see psittacus and trogon)
Chromaphis (see juglandicola)
Chrostheipus 116
Chrysopsacris 125
Chrysotus 275
chusca (Polites) 148
cinereiventre (Syntormon) 277, 279, 280
citricornis (Taeniopoda) 254, 256, 270
Cladonotae 79, 81
clavatum (Syntormon) *Van Duzee* 277, **281**
clitus (Thanaos) 201, 202, 203
cofaqui (Megathymus) 207
cognata (Rivellia) 228
coloradensis (Megathymus) 206
colorado (Pamphila) 184, 185, 186, 189, 191
Colpolopha (see rehni and sinuata)
columbia (Pamphila) .. 184, 190, 193
comma (Pamphila) 184, 188, 189, 190, 191
Compsacres 97
Compsacris 97
concinnula (Orphulella) 95
concinnulus (Stenobothrus) 95
conflua (Pamphila) 184
conjuncta (Rivellia) 225
conspersipes (Nautia) 107
conspicua (Atrytone) 65, 67
convergens (Hippodamia) 163
Copiocera (see erythrogastra, harroweri, laeta and specularis)
Copiocerae 114, 120
Coptacra (see foedata)
Cora (see chirripa)
Cornops (see longipenne)
corticina (Vilerna) *Hebard* **132**
Coscineuta (see coxalis and olivacea)
Coscineutae 123
costalis (Thanaos) 201
costaricensis (Anniceris) 126
costaricensis (Jodacris) 125
costaricensis (Orphulella) 96
coxale (Acridium) 128
coxalis (Coscineuta) 128
crenulata (Gryllus) 114
crenulata (Legua) 114
crenulata (Locusta) 114
cristalina (Philogenia) *Calvert* 7, 13, 16, 19, **35**

cristella (Trilophidia)..... 216
cyanea (Scyllina)..... 158
cyanipes (Scyllina).....98, 157
cyanomera (Scyllina).....157, 158
Cycloneda (see rubipennis)
cylindrodes (Opshomala)....116, 117
cylindrodes (Opsomala)..... 116
Cylindrotettix..... 116
(see also herbaceus and insularis)
Cynodon (see dactylon)
Cyrtacanthacri..... 133
Cyrtacanthacrinae....100, 212, 217
Cyrtacanthacris (see impleta)

Dacotae (Pamphila)..... 182
dacotah (Polites)..... 150
dactylon (Cynodon)..... 319
dairisama (Podisma).....219, 221
danica (Locusta)..... 215
danicus (Gryllus)..... 215
delaware (Atrytone)..... 64
dentata (Otumba)..... 84
dentipes (Taeniophora)..... 107
depressicornis (Aristia)..... 129
deva (Atrytonopsis).....68, 70
Diaphorus..... 275
Dicaearchus..... 76
Diedronoti..... 101
Diedronotus (see rosulentus)
dilutus (Listrus)..... 314
dion (Atrytone).....65, 67
dissimilipes (Syntormon) *Van Duzee*.....277, 279, **283**
distincta (Rhagovelia).243, 245, 247
Dolichopodidae..... 275
draco (Polites)..... 148
Draconata..... 76
drucei (Megathymus).....205, 208
drury (Hesperia)..... 156
druryi (Catia)..... 154
dukesi (Atrytone)..... 65
dumetorum (Callophrys)..... 329
dux (Tropidacris)..... 106

Edax (Gelastorrhinus)..... 212
edwardsi (Atrytonopsis).....70, 73
egeremet (Catia)..... 156
Elaeochlora..... 102
(see also caternaultii)
elegans (Ischnura)..... 289
elisabeta (Philogenia) *Calvert* 12, 13, 15, 19, **29**
elongatum (Eriogonum)..... 324
emarginata (Procolpia)..... 101
emarginata (Xiphocera)..... 101
ennius (Thanaos)..... 201
ensicornis (Piezops)..... 136
ensicornis (Rhytidochrota)..... 136
Episcopotettix..... 114
eques (Rhomalea)..... 256
eques (Taeniopoda) 253, 254, 256, 260, 261, 264
erinaceus (Nicarchus)..... 76
Eriogonum..... 324
(see also elongatum, fasciculatum, foliolosum, latifolium and porifolium)
erynnoides (Pamphila)..... 190
Erynnis (see attalus)
erythrogastra (Copiocera)..... 121
esox (Gelastorrhinus).....211, 212
Euclea (see terminalis)
Eumastacinae..... 92
Eumastax (see cerciata, surda and surdus)
Euparatettix..... 211
(see also histricus)
Euprepocnemis (see plorans and shirakii)
Eutarsus..... 275
Euthynous..... 212
Euxesta.....230, 239
(see also magdalenae, minor, nitidiventris, notata, pulchella, remota and stigmatias)
excelsa (Scyllina)....157, 158, 160
expansa (Philogenia) *Calvert* 12, 17, **50**

Fabaceae..... 329
fasciata (Scaria)..... 91
fasciculatum (Eriogonum)..... 324
fastigiatus (Parapleurus)..... 213
fauriei (Pezotettix).....219, 221

fauriei (Podisma) 221
femorata (Taeniophora) 109
femoratum (Syntormon) *Van Duzee* 277, 279, **280**
ferruginosa (Amblytropidia) ... 94
festae (Hisychius) 76
flavescens (Pantala) 289
flavicincta (Rhagovelia) *Bueno* 243, 244, 246, **249**
flavida (Taeniopoda) 271
flavimana (Rivellia) 227, 228
flavo-lineata (Osmilia) 131
flavo-lineatum (Acrydium) 131
flavosignata (Nautia) 107
foedata (Coptacra) 220
foliolosum (Eriogonum) 324, 330
frey-gessnerii (Paratettix) 87, 88, 89
fumatus (Stenobothrus) 213
funeralis (Thanaos) 203, 204
fusca (Acryptera) 213

Geniculatus (Ampelophilus) 127
geniculatus (Anniceris) 125
Gelastorhini 211, 212
Gelastorrhinus 212
(see also edax, esox, gracilis and lucius)
gibbera (Mezentia) 112
gibbinotus (Platytettix) 83
glabrum (Syrmatium) 329
Glaucopsyche (see xerces)
gloriosa (Lophacris) *Hebard* **104**
goethalsi (Opshomala) *Hebard* .. **117**
Gomphoceri 213
Gonista 212
(see also antennata and bicolor)
gorgasi (Leuconotus) *Hebard* ... **97**
gossypii (Aphis) 170
gracilicornis (Leioscapheus) 125
gracilis (Gelastorrhinus) 211
gracilis (Tettix) 90
gregaria (Schistocerca) 135
gregaria (Scyllina) 98
grossus (Gryllus) 212
grossus (Mecostethus) 213
grossus (Stethophyma) 213
grandis (Archilestes) 38
Gryllus (see alliaceus, bicolor, centurio, crenulata, danicus, grossus, marmoratus, obliquus, parapleurus, reticulatus, succinctus, tamulus, tataricus, turritus and velox)
gutturosa (Taeniopoda) 254, 255, 269, 271

Hachijoensis (Paratettix) 209
haitensis (Choranthus) 61
hamata (Scaria) 91
hancocki (Micronotus) 90
harpalus (Pamphila) 182
harroweri (Copiocera) *Hebard* ... **120**
harroweri (Platytettix) *Hebard* 80, **81**, 83
hebardi (Microtylopteryx) 137
helena (Philogenia) 2, 3, 13, 15, **19**, **20**
Heliastus (see sumichrasti and venezuelae)
Henia 76
herbaceus (Cylindrotettix) 116
Herina (see metallica, quadrifasciata and ruficeps)
Hesperia (see drury and vitellius)
Hesperiidae 57, 141, 177, 319
hesperus (Paratettix) 86
Heteragrion 11
Heteropternis 216
(see also pyrrhoscelis, respondens, sinensis and varia)
hianna (Atrytonopsis) 68
Hiatus 236
Hippodamia (see convergens)
histrica (Tetrix) 210
histricus (Euparatettix) 210
Hisychius (see festae)
hobomok (Poanes) 58
Homalocephala 235
(see also albitarsis)
horatius (Thanaos) 202
horus (Pamphila) 193
Hosackia 329, 330
(see also lathyroides and strigosa)
howardi (Poanes) 60
humile (Rhicnoderma) 110

humilis (Tephronota) 230
huron (Atalopedes) 141
Hyalopteryges 93
Hylephila (see brettoides and phylaeus)
hymenea (Pantala) 289, 291

Icelus (Thanaos) 193
idaho (Pamphila) 184, 190
immaculatus (Atrytone) 68
impleta (Cyrtacanthacris) 133
impleta (Schistocerca) 133
inclarata (Munatia) 101
inclarata (Procolpia) 101
inclarata (Xiphocera) 101
infernalis (Oedaleus) 214
inopinata (Thaumatoneura) 50
insignis (Amblytropidia) 94
insolitus (Paurotarsus) 91
insularis (Cylindrotettix) 116
insularis (Leptysma) 116
intricata (Oxya) 217
intricatum (Acridium) 217
Inusia (see bicolor, chipmani and nana)
Ischnura (see elegans)

Japonica (Patanga) 218
japonica (Trilophidia) 216
japonicum (Acridium) 218
japonicum (Acrydium) 210, 211
japonicus (Acanthalobus) 210
japonicus (Sphingonotus) 215
japonicus (Tettix) 211
Jivarus 76
Jodacris 125
(see also costaricensis)
juba (Pamphila) 184, 188, 189
juglandicola (Chromaphis) 170
juvenalis (Thanaos) 201, 203

Kawakamii (Podisma) 209, 219
kodamae (Podisma) 209, 219
kumskaka (Atrytone) 62

Lacustra (Thanaos) 195, 196
laeta (Copiocera) 121
lagus (Atrytone) 64
lankesteri (Philogenia) *Calvert* 12, 17, **51**
lasus (Pamphila) 183
lathyroides (Hosackia) 329
latifolium (Eriogonum) 330
latipennis (Stauroderus) 213
latipennis (Stenobothrus) 213
latiuscula (Anacampta) 233, 234
latiuscula (Ortalis) 233
latreillei (Acrydium) 106
latreillei (Tropidacris) 106
laurentina (Pamphila) 185
Legua 76, 114
(see also crenulata)
Leguae 114, 115
Leioscapheus 123
(see also gracilicornis)
leonardus (Pamphila) 181
Leptysma 116
(see also insularis and obscura)
Leptysmae 115, 116
Lerema (see accius)
Leuconotus 97
(see also biolleyi and gorgasi)
licinus (Pamphila) 183
lilius (Thanaos) 195, 198, 199
limbatipennis (Oxyblepta) 119
limbatipennis (Stenopola) 119
Limochores (see pontiac)
linea (Pamphila) 193
lineatum (Stethophyma) 214
lineola (Pamphila) 191
Linoceratium (see boucardi)
Listropsis 318
(see also armatulus and tinctus)
Listrus 318
(see also anacapensis, dilutus, obsoletus, sinuatus and variegatus)
loammi (Atrytonopsis) 68
Locusta (see australis, centurio, crenulata, danica, migratoria and tataricus)
logan (Atrytone) 64
longipenne (Acrydium) 120

longipenne (Cornops)..... 120
longipenne (Podisma)..... 220
Lophacris..... 104
(see also gloriosa and olfersii)
lucilius (Thanaos)..... 197
lucius (Gelastorrhinus)..... 212
lunus (Atrytonopsis)..... 70
luridipennis (Tetanops).....232, 233

Macneilli (Plectrotettix) 159, 160, 161
maculata (Megilla)..... 168
maculata (Oligoria)..... 73
maestus (Thanaos)..... 201
magdalenae (Euxesta) *Cresson*..**240**
magdalenae (Tetanops) *Cresson*. **233**
magister (Mecostethus)..... 214
magister (Stethophyma)..... 214
magna (Chaetopsis) *Cresson*.... **241**
magnificum (Rhicnoderma) *Hebard*.....**110**, 118
manataaqua (Polites).....149, 152
manitoba (Pamphila)..184, 185, 191
manitoboides (Pamphila)...181, 182
mardon (Polites)..... 153
margarita (Atrytonopsis)..... 71
margarita (Philogenia)
2, 3, 13, 16, 19, 31
mariae (Megathymus)..... 206
marmoratus (Gryllus)..... 214
marmoratus (Oedaleus)..... 214
marshalli (Opshomala)..... 116
martialis (Thanaos)..... 196
massasoit (Poanes)..... 57
massyla (Chaetopsis)..... 241
maxima (Taeniopoda).....267, 268
Mecostethi..... 212
Mecostethus.....212, 213
(see also alliaceus, grossus, magister and parapleurus)
medullaris (Argia)..... 50
megacephala (Taeniophora).... 110
Megapodagrion..... 3
Megathymus.....177, 204
(see also aryxna, cofaqui, coloradensis, drucei, mariae, navajo, neumoegeni, polingi, stephensi, streckeri, texana, ursus and yuccae)
Megilla (see maculata)
melane (Poanes).....57, 60
Melanopli..... 136
Melieria (see cana, obscuricornis, occidentalis and similis)
Melyridae..... 313
meridionalis (Ampelophilus) 127, 128
meridionalis (Anniceris)..... 127
meridionalis (Orphulella)..... 96
meridionalis (Paratettix)..... 86
meskei (Pamphila)..... 177
Metaleptea (see brevicornis)
metallica (Herina)..... 229
metallica (Rivellia)..... 229
metea (Pamphila)..... 183
Metrodorae..... 84
mexicanus (Orphulella)..... 96
mexicanus (Paratettix)..... 88
Mezentia..... 76
(see also gibbera)
Mezentiae.....110, 115
micans (Rivellia)..... 228
Micronotus (see caudatus, hancocki and quadriundulatus)
Microtylopteryx (see hebardi and nigrigena)
migratoria (Locusta).....209, 215
mikado (Pezotettix)..... 219
mikado (Podisma)..... 219
milo (Augiades)..... 142
minor (Euxesta)..... 239
minor (Opshomala)..... 116
Monachidium..... 76
(see also superbum)
montana (Pamphila).....178, 179
mormo (Apodemia)..... 324
morrisoni (Augiades)..... 142
Munatia (see biolleyi, inclarata and punctata)
mystic (Polites).....149, 150
Myzus..... 170
(see also persicae)

Nana (Inusia)..... 119
napa (Augiades).....143, 145, 150
nasuta (Acrida)..... 211
Nautia..... 107

(see also conspersipes, flavosignata and petasata)
navajo (Megathymus)..... 207
nemorum (Augiades).....142, 143
Neotettix (see barretti)
neumoegeni (Megathymus) 204, 206, 208
nevada (Pamphila).....185, 191
nicaraguae (Tettigidea)..... 91
Nicarchus (see erinaceus)
nigra (Paramastax)..... 76
nigrigena (Microtylopteryx) *Hebard*..... **137**
nigrinervis (Anniceris).....125, 126
nigrofasciatus (Oedaleus)..... 214
nitidiventris (Euxesta).....239, 240
nobilis (Stenobothrus)..... 159
notata (Euxesta).....239, 240
notata (Ortalis).....239, 240

Obesa (Rhagovelia)...243, 246, 250
obliqua (Abracris)..... 130
obliquus (Gryllus)..... 130
obscura (Leptysma)..... 119
obscura (Taeniopoda) 253, 256, 273
obscuricornis (Ceroxys)..... 230
obscuricornis (Melieria)....230, 231
obsoletus (Listrus) *Blaisdell*.... **314**
occidentalis (Melieria).....231, 232
occulta (Rivellia)..... 229
Ochetotettix (see barretti and volans)
ochricornis (Ceroxys)..... 230
Ocytes (see seminole)
Oedaleus (see infernalis, marmoratus and nigrofasciatus)
Oedipoda..... 216
(see also akitana and rufipes)
Oedipodinae.....99, 214
ogallala (Pamphila).....178, 179
olfersii (Lophacris).....104, 105
Oligoria (see maculata)
olivacea (Coscineuta)..... 123
olivacea (Orphulella)..... 97
olivacea (Rhicnoderma)..... 76
olivaceus (Ampelophilus)..... 127
olivaceus (Anniceris)..... 127
olivaceum (Rhicnoderma)..... 110
Olla (see abdominalis)
Opshomala (see chocoensis, cylindrodes, goethalsi, marshalli and minor)
Opomala..... 116
(see also bicolor)
Opthalmolampis.....76, 107
oregonia (Pamphila) 182, 189, 190, 193
oriander (Rhagovelia) 243, 246, 248
ornata (Traulia)..... 224
ornatipes (Syntormon) *Van Duzee*.....276, **277**, 279
Orphulella (see balloui, concinnula, costaricensis, meridionalis, mexicanus, olivacea, punctata and walkeri)
Orphulellae..... 84
Orphulina (see balloui and pulchella)
Ortalidae..... 225
Ortalis..... 234
(see also cana, latiuscula, notata, pyrrhocephala, snowi and stigma)
Osmilia (see flavo-lineata and violacea)
Osmiliae..... 130
otho (Catia)..... 154
otto (Pamphila)..... 146
ottoe (Pamphila).....178, 179
Otumba (see aciculata, dentata and quadrata)
ovidius (Thanaos)..... 204
Oxya (see intricata, velox, vicina and yezoensis)
Oxyblepta..... 138
(see also limbatipennis)

Pacuvius (Thanaos)..... 199
Patanga (see japonica and succincta)
Palaemnema..... 50
palatka (Atrytone)..... 65
pallida (Pamphila)..... 184
pallida (Polites)..... 150
pallida (Rivellia)..... 226
palmare (Syntormon) 276, 277, 279

Pamphila.....142, 177
(see also apennina, assiniboia, attalus, cabelus, californica, catena, colorado, columbia, comma, conflua, dacotae, erynnoides, harpalus, horus, idaho, juba, lasus, laurentina, leonardus, licinus, linea, lineola, manitoba, manitoboides, meskei, metea, montana, nevada, ogallala, oregonia, otto, ottoe, pallida, pawnee, ruricola, sassacus, slossonae, streckeri, sylvanoides, sylvanus, uncas, viridis and woodgatei)
panamae (Platytettix) *Hebard* 81, **83**
panamae (Taeniophora) *Hebard*. **107**
Pantala (see flavescens and hymenea)
Paramastax (see nigra)
paranense (Acridium)..... 135
paranensis (Schistocerca)..... 135
Parapleuri..... 212
Parapleurus..... 213
(see also fastigiatus)
parapleurus (Gryllus)..... 212
parapleurus (Mecostethus)..... 212
Parasyntormon.....275, 287
(see also quadratum)
Paratettix.....86, 211
(see also antennatus, aztecus, frey-gessnerii, hachijoensis, hesperus, meridionalis, mexicanus, peruvianus and toltecus)
parviverticis (Telmatettix)..... 87
patriae (Plectrotettix).....159, 160
Paulinia (see acuminata)
Paulininae..... 100
Paurotarsus (see amazonus, insolitus, ruficornis and rugosus)
pawnee (Pamphila).....178, 179
peckius (Polites).....153, 154
peragrans (Scyllina).....98, 157
peregrina (Schistocerca)..... 135
peregrinum (Acridium)..... 135
pernigra (Thanaos)..... 198
perplexa (Callophrys)..... 329
persicae (Myzus)..... 170
persius (Thanaos).....197, 198
peruvianus (Allotettix)..... 86
peruvianus (Paratettix)..... 86
petasata (Nautia)..... 107
petronius (Thanaos)..... 202
Pezotettix.....219, 220
(see also fauriei and mikado)
Phaeoparia..... 130
(see also annulicornis and rotundata)
Phaeopariae..... 128
Phenacolestes..... 3
pheres (Plebeius)..... 329
Philogenia..... 1
(see also augusti, berenice, carrillica, cassandra, championi, cristalina, elisabeta, expansa, helena, lankesteri, margarita, polyxena, raphaella, schmidti, silvarum, terraba and umbrosa)
phocion (Polites)..... 152
phylaeus (Hylephila)..... 319
phylaeus (Polites)..... 146
picticornis (Rhomalea) 256, 260, 261
picticornis (Taeniopoda) 253, 254, 256, 257, 258, 260, 261
Piezops..... 136
(see also ensicornis)
pilatka (Atrytone)..... 65
pittacus (Atrytonopsis)..... 70
Platyphyma (see azteca)
Platytettix.....76, 81
(see also harroweri, gibbinotus, panamae, reticulatus and uniformis)
Platythorus (see camurus)
plautus (Thanaos)..... 201
Plebeius (see pheres)
Plectrotettix (see calidus, macneilli and patriae)
plorans (Euprepocnemis)....223, 224
plumbea (Rhagovelia)..... 244
plumbea (Trochopus)..... 244

Poanes (see aaroni, hobomok, howardi, massasoit, melane, pocahontas, suffusa, taxiles, viator, yehl and zabulon)
pocahontas (Poanes) 58
Podisma 210, 219
(see also dairisama, fauriei, kawakamii, kodamae, longipenne, longipennis, mikado, sapporense, sapporensis and subaptera)
Poecilocloeus 76, 123
(see also rhabdotus)
polingi (Megathymus) 206
Polites 141, 146, 156
(see also alcina, baracoa, brettoides, brettus, cernes, chusca, dacotah, draco, manataaqua, mystic, pallida, peckius, phocion, phylaeus, rhena, sabuleti, siris, sonora, stigma, taumas, tecumseh, verna and vibex)
Polygonaceae 330
polyxena (Philogenia) *Calvert* 13, 15, 17, **27**
pontiac (Limochores) 67
porifolium (Eriogonum) 234
pratincola (Augiades) 145
Prionacris 76
Prionolopha 76
Problema *Skinner* and *Williams*. **62**
(see also bulenta and byssus)
Procolpia (see emarginata and inclarata)
Procolpiae 100
Proctolabus 123, 126
propertius (Thanaos) 199, 203
Prorachthes 114, 115
Proscopia 93
(see also septentrionalis)
Proscopinae 93
Protoneura (see remissa)
Prumna 220
Psaeroptera 235
Psaironeura (see remissa)
Psairoptera 235
(see also albitarsis, apicalis, bimaculata, biumbrata, similis and skinneri)
Pseudostauronotus (see brunneri)
Pseudotephritis 237
psittacus (Chromacris) 103
psittacus (Romalea) 103
pulchella (Euxesta) *Cresson* **240**
pulchella (Orphulina) 94, 95
pulchella (Taeniopoda) 263
pulchellum (Agrion) 289
punctata (Munatia) 76
punctata (Orphulella) 95, 96
punctatum (Acrydium) 96
Pycnosarci 137
Pyrgomorphinae 217
pyrrhocephala (Anacampta) . 234, 235
pyrrhocephala (Ortalis) 234
pyrrhoscelis (Heteropternis) ... 216
python (Atrytonopsis) 71

Quadrata (Otumba) 84
quadratum (Parasyntormon) ... 275
quadratum (Syntormon) 275
quadrifasciata (Herina) 227
quadrifasciata (Rivellia) 227, 228
quadriundulatus (Micronotus) .. 90
quadriundulatus (Tettix) 90

Radians (Choranthus) 61
raphaella (Philogenia) 2, 3, 13, 16, 19, 31
reducta (Vilerna) 132
rehni (Colpolopha) 102
remissa (Protoneura) 13
remissa (Psaironeura) 13
remota (Euxesta) *Cresson* **238**
respondens (Heteropternis) 216
reticularis (Taeniopoda) 266
reticulata (Taeniopoda) 103, 254, 256, 266, 267
reticulatus (Gryllus) 103, 267
reticulatus (Platytettix) 81, 83
rhabdotus (Poecilocloeus) *Hebard* **123**
Rhagovelia 243, 244
(see also angustipes, arctoa, armata, distincta, flavicincta, obesa, oriander, plum-

bea, rivale, tenuipes and varipes)
rhena (Polites) 153
Rhicnoderma 110, 113, 115
(see also humile, magnificum, olivacea and olivaceum)
Rhomalea 254
(see also auricornis, centurio, eques and picticornis)
Rhopalocera 319
Rhytidochrota (see ensicornis)
Rhytidochrotae 136
rivale (Rhagovelia) *Bueno* 243, 244, 245, **247**
Rivellia (see basilaris, brevifasciata, cognata, conjuncta, flavimana, metallica, micans, occulta, pallida, quadrifasciata, vanderwulpi, variabilis and viridulans)
Romalea (see psittacus)
rosulentus (Diedronotus) 102
rosulentus (Tropidonotus) 102
rotundata (Phaeoparia) 128
rubripennis (Cycloneda) 168
ruficeps (Herina) 230
ruficeps (Tephronota) 230
ruficornis (Paurotarsus) 92
rufifrons (Tetanops) 232
rufipes (Oedipoda) 216
rufiventris (Acrosticta) 237
rugosus (Paurotarsus) 92
rugulosus (Stenobothrus) 95
ruricola (Pamphila) 191

Sabuleti (Polites) 148
sassacus (Pamphila) 181, 182
sapporense (Podisma) 220, 221
sapporensis (Podisma) 221
Scaria (see fasciata and hamata)
Scelimenae 210
Schistocerca (see gregaria, impleta, paranensis, peregrina and separata)
schmidti (Philogenia) 3, 13, 15, 19, 28
scrobricularis (Acrosticta) 238
scudderi (Augiades) 146
scudderi (Thanaos) 199
Scyllina (see calida, cyanea, cyanipes, cyanomera, excelsa, gregaria, peragrans and viatoria)
Scyllinae 98, 157
seminole (Ocytes) 178
separata (Schistocerca) 135
septentrionalis (Proscopia) 93
septentrionalis (Taxiarchus) 93
serrata (Chiriquia) 84
shirakii (Euprepocnemis) 223
silvarum (Philogenia) 3, 13, 16, 38
Silvitettix 97
similis (Acrosticta) *Cresson* **238**
similis (Ceroxys) 232
similis (Melieria) 231, 232
similis (Psairoptera) *Cresson* **236**
simplex (Tylotettix) *Hebard* **79**
simplicitarse (Syntormon) *Van Duzee* 276, 279, **286**
sinensis (Heteropternis) 216
sinuata (Colpolopha) 103
sinuatus (Listrus) *Blaisdell* **313**
sinuatus (Tylotettix) 79
siris (Polites) 149
Sitalces 76
skinneri (Psairoptera) *Cresson* .. **237**
slossonae (Pamphila) 178
smithi (Megathymus) 208
snowi (Augiades) 145
snowi (Ortalis) *Cresson* **234**
somnus (Thanaos) 195
sonora (Polites) 148, 149, 152
specularis (Copiocera) 76, 120
Sphingonotus (see japonicus)
ståli (Taeniopoda) 253, 254, 257, 258, 260, 261
Stauroderus (see bicolor and latipennis)
Stenacris 116
Stenobothrus (see fumatus, latipennis, nobilis and viatorius)
Stenopola (see limbatipennis and xanthochlora)
Stenopolae 119
stephensi (Megathymus) 206
Stethophyma 212, 213

(see also grossus, lineatum, magister and variegatus)
Stethophymata.....212, 214
stigma (Ortalis)..... 235
stigma (Polites)..... 147
strataegum (Syntormon) 276, 277, 279, 284
streckeri (Megathymus)..... 207
streckeri (Pamphila)..... 61
strigosa (Hosackia)..... 329
subaptera (Podisma) *Hebard*.... **221**
succincta (Patanga).....218, 219
succinctus (Gryllus)..... 219
suffusa (Poanes)..... 58
sumichrasti (Heliastus)..... 100
superba (Taeniopoda)..... 266
superbum (Monachidium)..... 265
surda (Eumastax)..... 92
surdus (Eumastax)..... 92
sylvanoides (Augiades).....143, 145
sylvanoides (Pamphila).....181, 190
sylvanus (Pamphila)..... 191
Synarthrus..... 275
Syntormon..... 275
(see also affine, bisinuatum, cinereiventre, clavatum, dissimilipes, femoratum, ornatipes, palmare, quadratum, simplicitarse, strataegum and tricoloripes)
Syrmatium..... 330
(see also glabrum)

Taeniophora (see chocoensis, dentipes, femorata, megacephala and panamae)
Taeniophorae..... 107
Taeniopoda..... 253
(see also aurantia, auricornis, bicristata, burmeisteri, centurio, citricornis, eques, flavida, gutturosa, maxima, obscura, picticornis, pulchella, reticularis, reticulata, ståli, superba, tamaulipensis and varipennis)
Taeniopodae.....103, 254
tamaulipensis (Taeniopoda).255, 262
tamulus (Aiolopus)..... 214
tamulus (Gryllus)..... 214
taricus (Gryllus)..... 135
taricus (Locusta)..... 135
tatius (Thanaos)..... 202
taumas (Polites)..... 152
Taxiarchus..... 93
(see also septentrionalis)
taxiles (Poanes).....58, 60
tecumseh (Polites)..... 148
Telmatettix..... 86
(see also aztecus and parviverticis)
tenuipes (Rhagovelia)..... 245
Tephronota (see humilis and ruficeps)
terentius (Thanaos)..... 204
terminalis (Euclea)..... 2
terraba (Philogenia)...3, 12, 17, 52
Tetanops (see carbona, luridipennis, magdalenae, rufifrons and vittifrons)
Tetrataenia..... 76
Tetrataeniae..... 120
Tetrix (see histrica)
Tettigidea (see nicaraguae)
Tettix (see aztecus, caudatus, gracilis, japonicus, quadriundulata and tolteca)
texana (Megathymus)..... 208
Thanaos..... 177
(see also afranius, ausonius, brizo, burgessi, callidus, clitus, costalis, ennius, funeralis, horatius, icelus, juvenalis, lacustra, lilius, lucilius, maestus, martialis, pacuvius, pernigra, petronius, plautus, propertius, scudderi, somnus, tatius, terentius, tibullus, tristis, virgilius and zarucco)
Thaumatoneura (see inopinata)
Thymelicus (see aetna)
tibullus (Thanaos).....199, 203
tinctus (Listropsis)..... 318
Titanacris (see velasquezii)
tolteca (Tettix)..... 89

toltecus (Paratettix).....88, 89
Traulia (see ornata)
Trichochrous..... 318
tricoloripes (Syntormon) 276, 277, 279, 284
tricristata (Argiacris)..... 101
tricristata (Xiphicera)..... 101
Trilophidia (see annulata, cristella and japonica)
tristis (Thanaos)..... 202
Trochopus..... 244
(see also plumbea)
trogon (Chromacris)..... 104
Tropidacres..... 104
Tropidacris (see dux and latreillei)
Tropidonotus (see rosulentus)
truncatus (Ampelophilus)..... 127
truncatus (Anniceris)..... 127
Truxalis (see brevicornis)
Trybliophorus.....76, 107
turrita (Acrida)..... 211
turritus (Gryllus)..... 211
Tylotettix (see simplex and sinuatus)

Umbrosa (Philogenia) 3, 13, 15, 19, 22
uncas (Pamphila)..... 183
uniformis (Platytettix)..... 81
ursus (Megathymus)..... 208
utahensis (Polites)..... 149

Vanderwulpi (Rivellia) *Cresson*. **225**
varia (Epacromia) 216
varia (Heteropternis)..... 216
variabilis (Rivellia)..... 226
variegatus (Listrus)..... 316
variegatus (Stethophyma)..... 213
varipennis (Taeniopoda) 254, 255, 264, 271
varipes (Rhagovelia)..... 245
velasquezii (Titanacris)..... 104
Veliidae..... 243
velox (Gryllus)..... 218
velox (Oxya).....217, 218
venezuelae (Heliastus)..... 99
verna (Polites)..... 154
verus (Augiades)..... 143
vestris (Atrytone)..... 67
viator (Poanes)..... 57
viatoria (Scyllina)....157, 158, 159
viatorius (Stenobothrus)..... 159
vibex (Polites)..... 147
vicina (Oxya).....217, 218
vierecki (Atrytonopsis)..... 70
Vilerna (see aeneo-oculata, corticina and reducta)
Vilernae..... 131
violacea (Osmilia)..... 131
virgilius (Thanaos)..... 202
virgulti (Apodemia)..... 324
viridis (Pamphila).....188, 189
viridulans (Rivellia)..... 226
viridulus (Ampelophilus)..... 127
viridulus (Anniceris)..... 127
vitellius (Hesperia)..... 61
vittifrons (Tetanops)..... 233
volans (Ochetotettix)..... 90

Walkeri (Orphulella)..... 96

Xanthochlora (Stenopola)..... 120
xerces (Glaucopsyche)..... 329
Xiphicera (see tricristata)
Xiphocera (see emarginata and inclarata)

Yehl (Poanes)..... 61
yezoensis (Oxya)..... 209
yreka (Augiades)..... 142
yuccae (Megathymus)..... 206
yuma (Augiades)..... 145

Zabulon (Atrytone)..... 58
zabulon (Poanes)..... 58
zarucco (Thanaos)..... 204

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

VOLUME L

THE GENERIC CHARACTERS AND THE SPECIES OF PHILOGENIA SELYS (ODONATA: AGRIONIDAE)

BY PHILIP P. CALVERT

University of Pennsylvania, Philadelphia

(Plates I–V and Text-figures 1–20)

Contents

	PAGE
Abstract	1
Introduction	2
Historical Summary	2
Generic Characters	3
Penis	9
Genital Valves and Ovipositor	11
Prothorax	11
Geographical and Topographical Distribution	12
Seasonal Distribution	14
Key to the Species—Males	15
Females	17
The Species of Philogenia	20

Abstract

The results of a tabulation of thirty-two specimens, sixteen males, sixteen females, representing ten species, for twenty-one characters in both front and hind wings, to determine their value for generic diagnosis, are given and their variations stated in percentages. The endeavor is made to fix the specific

characters by the abdominal appendages of the males and the prothorax of the females from a study of two hundred and sixty males, and sixty-two females. These structures are figured, many of them for the first time. Seventeen species are recognized, the following six being here described as new: *polyxena* (♂ ♀), Venezuela; *elisabeta* (♂ ♀), Peru; *cristalina* (♂ ♀), Colombia; *augusti* (♂ ♀), Panama; *expansa* (♀), Costa Rica, and *lankesteri* (♀), Costa Rica; while a seventh, *berenice* (Hagen MS.) Higgins, Peru, hitherto known by the gizzard only, is described in more detail. The distribution of each species is apparently very limited, in contrast to that of other genera with which *Philogenia* is associated.

Introduction

The present paper has arisen from an attempt to identify the species of *Philogenia* more exactly than the existing literature will permit. Thanks to Dr. F. Ris, of Zürich, drawings of specimens in the Royal Museum at Brussels were made by M. Menger and forwarded to the United States during the war. After the peace, M. G. Severin, curator in the same Museum, supplied information as to the specimens so figured. Mr. Herbert Campion and Mr. C. L. Withycombe obtained for me drawings of the type of *Ph. raphaella* in the McLachlan collection in London. Mr. Nathan Banks and Mr. J. H. Emerton, by notes and figures, elucidated the type of *Ph. helena* Hagen in the Museum of Comparative Zoology at Cambridge, Massachusetts. Mr. Hugo Kahl has supplied some specimens from the Carnegie Museum at Pittsburgh and from his own collection, and Mr. F. M. Gaige some from the Museum of Zoology of the University of Michigan. The largest amount of material studied is that lent by Mr. E. B. Williamson with his usual generosity. To all of these friends I offer my hearty thanks.

Historical Summary

The genus *Philogenia* was established in 1862 by De Selys-Longchamps[1] for two species, *margarita* De Selys, from "L'Amazone par M. Bates," and *cassandra* Hagen, from "Venezuela, Porto Cabello (par Appun)." The first of these two species had previously appeared in literature[2] under the manuscript

[1] Bull. Acad. Roy. Sci. Lettr. & Beaux Arts Belg., (2) xiv, p. 10. The generic name apparently signifies "lover of its kind," a derivation supported by De Selys' remark of 1886 that it is a "genre très naturel."

[2] Hagen, Synop. Neur. N. Amer., p. 309, (1861).

name of *Euclea terminalis*. Brauer included the genus in his dichotomic key to the "Gattungen der Agrioninen" in 1868.[3] In 1869 Hagen added[4] a third species, *helena*, from Bogotá, collected by Lindig. A fourth species, *raphaella*, likewise from Bogotá, appeared in De Selys' *Revision du Synopsis des Agrionines* of 1886,[5] in which is also a key to the genera allied to *Philogenia* ("Legion Podagrion") on page 31. Kirby first designated a genotype (*margarita*) and catalogued the above-mentioned four species.[6] Calvert, by describing *Ph. championi* from Panama[7] and *Ph. terraba* and *carrillica* from Costa Rica,[8] showed that the genus was not confined to South America, and figured, for the first time, the appendages of some of the males. The same writer gave a comparison of *Philogenia* with the Miocene *Phenacolestes* and included it in new keys to the legion Podagrion.[9] Ris made new generic keys, gave the first key to the species, the number of which he raised by the addition of *umbrosa* and *silvarum* from Peru and *schmidti* from Bolivia, and gave the first figure of the wing-venation of this genus.[10] Munz, in 1919, furnished still other keys to the Zygoptera, in which *Philogenia* finds a place, and another figure of the venation.[11]

Generic Characters

Thirty-two individuals, sixteen males and sixteen females, were tabulated to determine the amount of variation in characters which might be of generic value. All four wings of each specimen were included so that the features of sixty-four front (thirty-two ♂, thirty-two ♀) and sixty-four hind (thirty-two ♂, thirty-two ♀) wings were recorded. The species employed in

[3] Verhd. zool.-bot. Ges. Wien, jahrg. 1868, p. 382.

[4] Stettiner Ent. Zeit., xxx, p. 261.

[5] Mem. couron. Acad. Sci. Belg., xxxviii, p. 37.

[6] Cat. Odon., p. 122, (1890).

[7] Biol. Cent.-Amer., Neur., p. 61, (1901).

[8] Ibid., p. 356, (1907).

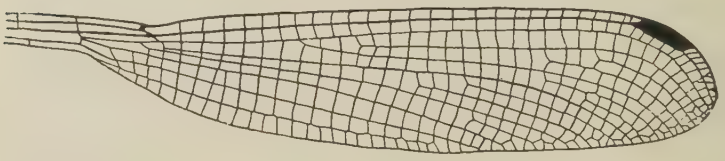
[9] Proc. Acad. Nat. Sci. Phila., 1913, pp. 235, 259, 262.

[10] Archiv f. Naturgeschichte, 82 jahrg., abt. A, 9 heft, pp. 75, 77–81, Taf. II, fig. 35, (1918). The wing figured by Needham, Proc. U. S. Nat. Mus., xxvi, pl. liii, fig. 4, (1903), as *Philogenia* is not of this genus but is a *Megapodagrion* Selys (*Allopodagrion* Foerster).

[11] Mem. Amer. Ent. Soc. no. 3, p. 51, pl. x, fig. 59.

the tabulation were as follows, it being thought that a wider specific representation, even of few individuals, was preferable to using more examples but of fewer species: *Ph. helena*, one ♂; *cassandra*, two ♂, three ♀; *schmidti*, one ♂; *elisabeta*, one ♀; *raphaella* (?), one ♂; *berenice*, two ♂; *cristalina*, three ♀; *silvarum*, three ♀; *augusti*, four ♂, one ♀; *carrillica*, two ♂, one ♀; *expansa*, one ♀; *lankesteri*, one ♀; *terraba*, three ♂, two ♀.

The characters examined were as follows, the figures in parentheses after each indicating the percentage of the total number of individuals (or of wings) tabulated, which possessed that character:



Text-figure 1. *Philogenia terraba*, ♂, Pacuare del Sur, Costa Rica. Right front wing. After Munz. This figure does not represent the predominant conditions of the tabulated material in the following two features: (1) the subnodal sector arises slightly distad to, instead of at, the subnodus; (2) there are three distal quadrilateral antenodal cells instead of two.

Wings. Two antenodal cross-veins on both front (100) and hind (100) wings, no brace vein to the stigma on front (100) or hind (100) wings, no supplementary sectors between the principal and the ultra-nodal sectors of the front (100) or hind (96.9) wings, two such between the ultra-nodal and nodal sectors, front (100) and hind (98.4) wings, two between subnodal and median sectors of both front (100) and hind (100) wings, postcostal cross-vein nearer to the level of the first than to that of the second, or distal, antenodal cross-vein on both front (100) and hind (100) wings, inferior sector of the triangle separating from the hind margin of the wing at a level distad of the arculus on both front (100) and hind (100) wings, one row of cells behind the inferior sector of the triangle of both front (100) and hind (100) wings, two supplementary sectors between the nodal and subnodal sectors on front (98.4) and hind (98.4) wings, the posterior

of the two supplementary sectors between the subnodal and the median sectors is the longer on front (98.4) and hind (81.3) wings, median sector arising proximad to the levels of both subnodus and of nodus on hind (96.9) and nearly at nodus level on front (70.3) wings, subnodal sector arising at the subnodus on front (92.1) and hind (87.5) wings, one supplementary sector longer than 3 cells between the median and short sectors on front (92.1) and hind (79.7) wings, two distal quadrilateral antenodal cells on hind (76.6) and front (51.6) wings, posterior distal angle of quadrilateral estimated to be ca. 45° on front (64.7) and hind (54.7) wings, arculus at the second antenodal cross-vein of the front (32.8 in ♂ + 23.4 in ♀ = 56.2) and hind (23.4 in ♂ + 28.1 in ♀ = 51.5) wings or slightly distal, *i.e.* by less than the upper limb of the arculus, to the second antenodal cross-vein of the front (17.2 in ♂ + 26.6 in ♀ = 43.8) and hind (26.6 in ♂ + 21.9 in ♀ = 48.5) wings. The ratio of the length of the front wings to the distance of the nodus from the wing base ranges from 3.70 to 4.35, average 3.78 in ♂, from 3.75 to 4.12, average 3.94 in ♀; the corresponding figures for the hind wings are 3.56–4.4, average 3.975 in ♂, 3.39 to 4.12, average 3.79 in ♀.

Legs: Tarsal claws toothed, except where the tarsus had been injured in earlier life and regenerated.

Superior Abdominal Appendages of Male: having a longitudinal groove on the ventral surface for the entire length, the mesal margin of this groove usually produced ventrad as a process (except in *Ph. championi*) varying in outline in the different species; armed near mid-length on the dorsal surface with a group of spinules.

Gizzard lining with eight larger folds alternating with eight smaller, all the sixteen folds armed with numerous teeth.[12]

The following *pattern of coloration* is characteristic of the genus: Dorsal surface of the head blackish, a dull pale brownish stripe from each lateral ocellus to the adjacent eye, behind the antenna. Rear of the head pale yellowish, a blackish spot opposite the attachment of each maxilla. Labrum, external

[12] Higgins, Proc. Acad. Nat. Sci. Phila. 1901, p. 136. Only two species were examined, however, *Ph. berenice* Hagen and *Ph. cassandra* Hagen. The latter is really *Ph. championi* Calvert.

surface of each mandible and adjacent part of gena pale green, greenish-blue or yellow, narrowly margined with black; in the females the central portions of these areas are often more or less clouded with blackish. Median labial lobe with more or less black.

Thorax with the mid-dorsal carina, the carinae bounding the pleura superiorly, most of the mesinfraepisternum, the small depression in the humeral suture near its upper end, a stripe along the posterior margin of the metepisternum, one on the metepimeron and others, varying according to the species, black; paler parts of the thorax dull browns or yellows; pectus yellow except in *Ph. berenice* and *Ph. schmidti* (old individuals).

Abdomen blackish; a spot, or spots, or longitudinal stripe, on each side of segments one and two, a transverse basal ring, often interrupted mid-dorsally, on three to seven; a lateral stripe extending caudad from this ring on three and often on the following segments, pale green or yellowish; one or more of the hindmost segments pruinose dorsally in older males.

Except where some special condition demands mention of them, these details of the coloration are not repeated in the specific descriptions which follow.

In the above statement for the wings, the characters have been arranged in order from least variable to most variable. The old Selysian vein nomenclature has been used by reason of the Comstock-Needham notation having been recently called in question by Dr. Tillyard and Prof. Lameere. The homologies thus involved concern all insects and not merely the Odonata. Until these are determined it would seem to lead to less confusion to resort to the Selysian terms. Some further statements as to the wing characters of *Philogenia* are possible and desirable.

In the remaining material not tabulated for generic characters two individuals (of *Ph. cassandra*), both males, were found to have *three antenodal cross-veins* in one wing each: ♂ no. 119 (San Esteban, Venezuela, Feb. 8, 1920) has the additional cross-vein in the costal area only of the left front wing, at a little more than mid-way between the two normal cross-veins; ♂ no. 125 (Bejuma, Venezuela, Feb. 14, 1920) has the additional cross-vein in the costal area only of the right front wing nearly midway between the two normal cross-veins. At the lowest estimate

these two wings give an occurrence of three antenodal cross-veins cr .155% of 1288 wings (322 insects); other occurrences of three antenodal cross-veins among this material may have been overlooked.

One male (of *Ph. cassandra*, no. 124, Bejuma, Venezuela, Feb. 14, 1920), not included among those tabulated above, was found to have *more than one postcostal cross-vein* on three of its wings: on the right front wing there were two of these cross-veins, one proximal, the other distal, to the level of the first antenodal cross-vein; three on the right hind wing, two of them proximal, one distal, to the level of the first antenodal; two on the left hind wing, placed as on the right front wing; the left front wing was normal in this respect. One male of *Ph. cristalina* (no. 7, Cristalina, Colombia, Feb. 7, 1917), not included in those tabulated above, has the right front wing with one normal postcostal cross-vein; two postcostal cross-veins, one in normal position, the other proximal to the level of the first antenodal cross-vein, on the left front wing; two postcostal cross-veins, similarly placed, on the right hind wing; three postcostal cross-veins, two of them similarly placed, the third distal to the other two but proximal to the level of the second antenodal cross-vein, on the left hind wing.

Although the inferior sector of the triangle separates from the hind margin of the wing at a level distad of the arculus in 100% of the front and of the hind wings tabulated, these totals were made up of 14.1% (12.5 in ♂ + 1.6 in ♀) having the separation at the level of the distal anterior angle of the quadrilateral and 85.9% (37.5 in ♂ + 48.4 in ♀) having the separation between the levels of the arculus and of the angle mentioned—for the front wings. For the hind wings the corresponding figures were 9.4% (all ♂) and 90.6% (40.6 in ♂ + 50 in ♀).

The relative lengths of the two supplementary sectors between the subnodal and median sectors in the tabulated material was found to be as follows: front wings, posterior sector longer 98.4%, the two sectors equal 1.6% (♀); hind wings, posterior sector longer 81.3% (42.2 in ♂ + 39.1 in ♀), anterior the longer 9.3% (3.1 in ♂ + 6.2 in ♀), the two sectors equal in length 9.4% (4.7 in ♂ + 4.7 in ♀).

The median sector on the front wings arose at nearly the nodus level in 70.3% (35.9 in ♂ + 34.4 in ♀) and proximad to the levels of both subnodus and of nodus in 29.7% (14.1 in ♂ + 15.6 in ♀), of the tabulated material.

The subnodal sector on the front wings arose at the subnodus in 92.1%, proximad thereto in 3.1% (♂) and distad thereto in 4.7% (3.1 in ♂ + 1.6 in ♀); on the hind wings at the subnodus in 87.5% (42.2 in ♂ + 45.3 in ♀), distad thereto in 12.5% (7.8 in ♂ + 4.7 in ♀), of the tabulated material.

By the distal quadrilateral antenodal cells are meant those cells lying between the short sector and the upper sector of the triangle included between the distal side of the quadrilateral and the cross-vein which descends from the subnodus. The numbers of these cells in the tabulated material were as follows: front wings, 3 + 4.7%, 3 26.6%, 2 + 17.2%, 2 51.6%; hind wings, 3 10.9%, 2 + 3.1%, 2 76.6% (42.2 in ♂ + 34.4 in ♀), 1 + 7.8% (♀). Except where figures for the sexes are given, the two sexes were fairly evenly divided for each number of cells. It will be seen that the generic range in number of these cells is from 3 and a fraction (3 +) to 2 cells, front wings; 3 to 1 and a fraction (1 +) cells, hind wings.

No generic value can be attached to the following features:

The point of origin of the ultra-nodal sector with respect to a given postnodal cross-vein, the range being from between the fourteenth and fifteenth to the eighth, maximum (23.4% of the tabulated material) at the tenth postnodal, front wings; from the thirteenth to between the sixth and seventh, maximum (21.9% of the tabulated material) at the ninth postnodal, hind wings.

The point of origin of the nodal sector with respect to a given postnodal cross-vein, the range being from the tenth to the sixth, maximum (25% of the tabulated material) between the seventh and eighth postnodals, front wings; from the tenth to between the fifth and sixth, maximum (28.1% of the tabulated material) between the sixth and seventh postnodals, hind wings.

The point of origin of the longest of the supplementary sectors between the ultra-nodal and the nodal sectors as measured in number of cells in the median space proximal to the pterostigma, the range being from ten cells to none, maximum (12.5% of

the tabulated material) four plus cells, front wings; from ten cells to none, maximum (14.1% of the tabulated material) six plus cells, hind wings. It is noticeable that the range for the front wings is ten to two plus for the males, seven plus to none for the females and for the hind wings ten to three plus for the males, seven plus to none for the females.

The median nerve of de Selys (radius of Comstock and Needham) has on its upper surface short, stout spines, both proximad and distad of the nodus; on the postnodal portion they are less numerous than the postnodal cross-veins; they are curved or straight, directed dorsad and distad, each with an acute apex, and much stouter than the spines so frequent on the cross-veins. I have not determined whether allied genera possess them nor whether they have been mentioned by writers on the wings of Odonata.

Penis

The penis of "*Philogenia* sp. (Rio Songo, Bolivia)" (subsequently described by Dr. Ris[13] as *Ph. schmidti*) has been figured by Dr. Erich Schmidt[14] from a specimen boiled in potassium hydrate and preserved in alcohol. The penis of *Philogenia terraba* has been figured by Dr. C. H. Kennedy[15] from a dry specimen, which was relaxed, the penis extruded, but not removed from the body, and the drawing made therefrom. I have not made use of the caustic potash treatment but have examined the penes prepared in the manner employed by Dr. Kennedy and which will most frequently be the only method available for many students.

On comparing the dried penes, therefore, of the eleven species of *Philogenia* accessible to me, the principal differences in structure which become apparent are in that part called *limbus membranosus* by Rathke[16] and Dr. Schmidt[17] and *terminal fold* by Dr. Kennedy.[18] These differences are very evident in the

[13] Archiv f. Naturgesch. 82 jahrg., abt. A, 9, heft, pp. 77, 79, (1918).

[14] Zool. Jahrb., Abt. Anat. Ontog., xxxix, heft 1, taf. 11, fig. 62, (1915).

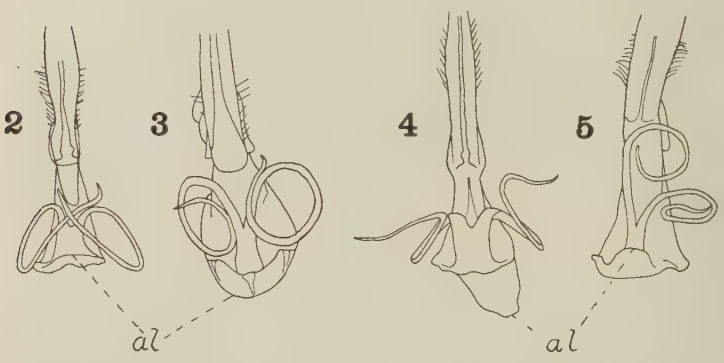
[15] Ohio Journ. Sci., xxi, pl. iii, figs. 113, 114, (1920).

[16] De Libellarum partibus genitalibus, tab. iii, figs. 2 and 5, *o*. Regimonti, 1832.

[17] Op. cit., pp. 142, 143, tab. 10, fig. 18, *lm*.

[18] Ent. News, xxvii, p. 327, diagram, (1916).

two figures of *Philogenia* penes by Drs. Schmidt and Kennedy above cited, Dr. Schmidt's figure showing the limbus membranosus as projecting freely caudad and one and one-half times as long as its width at base, with subparallel sides and rounded apex. In *Ph. terraba*, as figured by Dr. Kennedy, the limbus is folded ventrad, applied against the third segment of the penis and its length is apparently less than its width.



Figures 2–5. Ventral views of penes of *Philogenia schmidti* (Coroico, Bolivia), *carrillica* (Juan Viñas, Costa Rica, April 26), *cassandra* (Venezuela, Schneider) and *raphaella*? (Bogotá, from Suffert), respectively; *al*, apex of the limbus membranosus, or terminal lobe.

I believe that these differences are due to the drying and shrinking of the limbus membranosus, to which Dr. Schmidt justly applies the term "dünnhäutig" and which, Dr. Kennedy says, (although for another genus) "is at times gossamerlike and if the specimen is the least dry clings so closely to the terminal segment that the most careful dissection may fail to loosen it." Our accompanying figure 2, showing a *dried* penis of *Ph. schmidti*, is very similar, in the limbus, to Dr. Kennedy's figure of *Ph. terraba* and hence very different from Dr. Schmidt's figure of *Ph. schmidti* and is sufficient to establish the effects of drying and shrinkage. In six males of *Ph. carrillica*, whose dried penes have been carefully examined, the appearance of the limbus varies from a condition like that shown for *Ph. schmidti* (figure 2) to that in figure 3 drawn from *Ph. carrillica* itself. Four males of *Ph. augusti* show a similar varying amount of contraction in the

limbus. Two other figures (4, 5) which we present from other species of this genus show that even in dried penes the limbus may remain somewhat extensive. I have also seen some dried specimens of *Ph. cassandra* in which the limbus is clearly visible folded against the *dorsal* surface of the second segment of the penis.

It would seem, therefore, to be unjustifiable to base any specific characters on the limbus membranosus in the dried condition, so no further reference to the penis of *Philogenia* is made in this paper.

Genital Valves and Ovipositor

The genital valves of the females are fairly stout in proportion to the thickness of the abdomen. They project as far as the level of the hind end of segment eleven, or beyond that level; the style, with which each is furnished, is usually longer than the abdominal appendages (of segment ten). Unlike the genus *Heteragrion*, recently studied by Mr. Williamson,[19] the ventral edges of the valves are not toothed but entire under low magnification. Under the compound microscope (*e. g.*, 120 diameters) the edge shows low, distant serrations, each serration marked on its distal side by the insertion of a chitinous hair directed distad.

The two dorsal pieces (posterior of Mr. Williamson) of the ovipositor are transversely grooved, for their entire width, at short intervals, in their distal portion, giving them a scutellate appearance, the "scutella" directed proximad. The two ventral pieces (anterior of Mr. Williamson) are smooth.

Prothorax

The chief specific characters distinguishing the males of *Philogenia* from each other are the forms of the terminal abdominal appendages. We owe to Mr. E. B. Williamson the observation, recorded *posteá* under *Ph. cassandra*, that in pairing the "male holds female entirely by hind lobe of [her] prothorax, [his] superiors behind, inferiors above." It would be natural,

[19] Occasional Papers of the Museum of Zoology, University of Michigan, no. 68. Ann Arbor, Mich., April 24, 1919. See especially pp. 6 and 7 and figs. 54–62, 67–73.

therefore, to expect correlations in the shape of the prothorax of the females with the shape of the complex abdominal appendages of the males of the same species, but I have not been able to demonstrate these. Differences in shape of the prothorax of females of different species do exist and I have succeeded in distinguishing most of the species in this sex by means of this segment. The *Key to Females* on a later page is based on this fact.

The two sexes of the same species may have the prothorax not very unlike, as in *Ph. terraba* (♀, text-fig. 12, page 18); or moderately different, as in *Ph. elisabeta* (♀, text-fig. 8, page 18; ♂, fig. 43, pl. II); or very dissimilar, as in *Ph. cassandra* (♀, text-fig. 6, page 18; ♂, figs. 52–54, pl. III), in *Ph. silvarum* (♀, text-figs. 14, 15, page 18; ♂, fig. 80, pl. V) and in *Ph. augusti* (♀, text-fig. 20, page 18; ♂, fig. 81, pl. V). An interesting difference is to be seen on comparing *Ph. cassandra*, from northern Venezuela, and *Ph. silvarum*, from central Peru. In the former, the prothorax of the *male* is produced into an acute process on each side (figs. 52–54, pl. III), while the female lacks any such processes (text-fig. 6, page 18). In *Ph. silvarum* it is the prothorax of the *female* which possesses such angulate processes (text-figs. 14, 15, page 18), although such are wanting in the male (fig. 80, pl. V).

Geographical and Topographical Distribution

As far as present information extends, Costa Rica on the north and central Bolivia on the south are the limits in latitude of the area occupied by this genus. Its most eastern extension is Teffe, or Ega, on the Amazon, between 64° and 65° West Longitude, while in Costa Rica at least it reaches the lower lands of the Pacific slope. Arranged geographically the species are as follows:

Costa Rica

Pacific slope *Ph. terraba*	Atlantic slope *Ph. carrillica*
	Ph. expansa
	Ph. lankesteri

Panama

Pacific slope *Ph. championi*	Atlantic slope *Ph. augusti*

Colombia	Magdalena drainage	*Ph. cristalina*
		Ph. raphaella
		Ph. helena
Venezuela (northern)		
Common to coastal & Orinoco drainage		*Ph. cassandra*
Coastal		*Ph. polyxena*
Peru	Amazon drainage	*Ph. berenice*
		Ph. elisabeta
		Ph. silvarum
		? *Ph. umbrosa*
Bolivia	Amazon drainage	*Ph. schmidti*
Brazil (on the Amazon)		*Ph. margarita*

The *Philogeniae* are dwellers in forests, often dark forests, and each species appears to inhabit a relatively small area; thus, the localities in which *Ph. cassandra* has been taken in Venezuela are at the most but eighty kilometers apart. Similarly, the extreme distance separating the places in which *Ph. carrillica* has been found is about one hundred kilometers (62 miles), measuring in a straight line in both instances. The only exception to this statement is in the record of *Ph. helena* from Peru as well as Colombia, from which latter it was originally described; possibly the label "Peru" on the single male in question (see *posteá*, page 20) is incorrect.

This restricted distribution of each species of *Philogenia* is the more remarkable when contrasted with that of a much smaller and more delicate species, *Protoneura* (*Psaironeura*) *remissa*, with which *Philogenia* is not infrequently associated. This species has been found from Mexico to Colombia.[20] When it is considered how few are the areas of tropical America in which intensive search for Odonata has been made, the foregoing data make it likely that many new species of *Philogenia* are to be found when additional tracts are explored.

In connection with the preceding list of species arranged by countries (*supra*), it may be pointed out that some anomalies in distribution apparently exist. Thus *Ph. schmidti* of Bolivia

[20] Biol. Centr.-Amer., Neur., pp. 146, 397. Williamson, Proc. U. S. Nat. Mus., vol. 48, p. 629, (1915); Univ. Mich. Mus. Zool. Misc. Pub., no. 3, pp. 6, 12, (1918).

finds its nearest allies in *cassandra* and *polyxena* of northern Venezuela, *Ph. raphaella* of the Magdalena drainage of Colombia in *Ph. berenice* of the Amazon of Peru. On the other hand, the Costa Rican and Panaman species form a fairly homogeneous group and with them *cristalina* of Colombia and *Ph. silvarum* of central Peru may be associated; *Ph. elisabeta* and *margarita* are nearly allied. *Ph. helena* of Colombia and *Ph. umbrosa* of southern Peru are each isolated forms structurally.

Altitude seems to have little influence in determining the distribution of *Philogeniae*. *Ph. carrillica* in Costa Rica has been taken at various stations from near sea-level to 1030 meters (3400 feet). A similar range is indicated for *Ph. cassandra* near San Esteban, Venezuela.

Seasonal Distribution

Most of the collecting dates for any station at which *Philogeniae* have been taken have been confined to a very limited part of the year. The fullest series of records are those for *Ph. carrillica* on the Atlantic slope of Costa Rica; here within a radius of thirty miles (fifty kilometers) males of this species have been taken at one station or another in every month except January, February and March; at the two stations at Juan Viñas they were collected from April to July inclusive, in October and in December. These dates fall within the so-called rainy season, but the distinction between rainy and dry seasons is not sharp within the area collected over. For *Ph. terraba*, of the Pacific slope of Costa Rica, we have a record of a female taken in March (dry season) and of two males and a female in October (wet season), all at the same station on the Rio Surubres, on this slope the seasons are ordinarily well distinguished. Bearing in mind the habitat of *Philogeniae*—in forests and generally near brooks and waterfalls—the probability is that this genus may appear at any time of the year in these habitats.

It is hoped to treat the larvae of *Philogenia* in a separate paper.

Key to the Species—Males

A. Inferior appendages distinctly shorter than the superiors (three-fourths as long or shorter); ventral process of the superiors without an angular extension toward the base of the appendage.

B. Inferior appendages each produced at apex on the lateral margin into a slender process which describes an arc of more than 90° and is expanded at its apex; wings in the adult ♂ blackish brown at apex from mid-length of the stigma, proximal edge of this brown nearly straight.
Ph. helena (Pl. I, figs. 21–24). Page 20.

BB. Inferior appendages with no such process as described for *helena*.

C. Inferior appendages in ventral view with apex bifid, lateral branch longer.

D. Inferior appendages in profile view showing no dorsal spines, apex of superiors in profile view broadly bilobed.
Ph. umbrosa (Pl. II, figs. 44, 45). Page 22.

DD. Inferior appendages in profile view showing two dorsal spines; hind lobe of pronotum with an acute-angled process on each side.
Ph. cassandra (Pl. I, figs. 25–28; Pl. III, figs. 52–54). Page 22.
Ph. polyxena (Pl. I, figs. 30, 31). Page 27.
(For statement of their differences see under *polyxena, posteá*, page 27.)

CC. Inferior appendages with apex entire.

E. Superior appendages in profile view with the ventral process projecting below the body of the appendage by more than one and one half times the thickness of the latter, approximately triangular, almost acute.
Ph. schmidti (Pl. I, figs. 32–35). Page 28.

EE. Superior appendages in profile view with the ventral process projecting below the body of the appendage by not more than the thickness of the latter; apex of wings dark brown, at least from the distal end of the stigma, in adult males.

F. Superior appendages in dorsal view unguiculate at apex, much wider (three times) anterior to the unguiculate portion; inferiors acute at apex; brown at apex of wings beginning under middle of stigma.

G. Inferior appendages with a transverse, dorsally projecting, lamellate process which in profile view appears like a tooth.
Ph. elisabeta (Pl. II, figs. 39–42). Page 29.

GG. Inferior appendages with no such process.
Ph. margarita (Pl. II, figs. 36, 37). Page 31.

FF. Superior appendages in dorsal view not unguiculate at apex which is expanded and curved mesad; brown at apex of wings beginning at distal end of stigma.

H. Inferior appendages straight, directed caudad, acute at apex in dorsal or ventral view.
Ph. raphaella (Pl. III, figs. 50, 51). Page 31.

HH. Inferior appendages curved dorsad at apex, truncated in dorsal or ventral view.
Ph. berenice (Pl. III, figs. 46–49). Page 33.

AA. Inferior appendages as long, or almost as long, as the superiors.

I. Ventral process of the superior appendages with no angular extension toward the base of the appendage when seen in dorso-mesal view; inferiors with a dorsal spine visible in profile view.
Ph. cristalina (Pl. IV, figs. 58–60, 64). Page 35.

II. Ventral process of superior appendages with an angular extension on its proximal side directed toward the base of the appendage (seen best in dorso-mesal view).

J. Inferior appendages in their distal halves, or more, not convergent, usually divergent or parallel, nearly straight.

K. Inferior appendages tapering to apex in dorsal or ventral view.

L. Angular extension mentioned under II above not notched; eleventh segment well developed with a mid-dorsal longitudinal groove and bilobed at apex.
Ph. silvarum (Pl. IV, figs. 61–63, 65). Page 38.

LL. Angular extension, etc. notched; eleventh segment feebly developed, with no mid-dorsal groove, not bilobed at apex.
Ph. augusti (Pl. IV, figs. 66–69). Page 42.

KK. Inferior appendages truncated at apex in ventral view, thence bent dorsad and mesad.

M. Superior appendages with their meso-ventral margin not produced ventrad as a distinct process, when seen in profile view, but forming a slightly convex curve; in dorsal view with a prominence at mid-length of the mesal margin.
Ph. championi (Pl. III, figs. 55–57). Page 44.

MM. Superior appendages with their meso-ventral margin produced ventrad as a distinct process, when seen in profile view, in the distal three-fifths of the appendage length; in dorsal view with a prominence at mid-length of lateral margin.
Ph. carrillica (Pl. V, figs. 70–73, 77, 78). Page 45.

JJ. Inferior appendages in their distal halves convergent, curved toward each other, with an anteapical dorso-mesal tooth.
Ph. terraba (Pl. V, figs. 74–76, 79). Page 52.

The males corresponding to the females here described as *Ph. expansa* and *Ph. lankesteri* have not been recognized.

Key to the Species—Females

A. Hind lobe of pronotum as a whole convex in antero-dorsal view, not produced into an acute angulate process, directed laterad, on each side.

B. Sides of hind lobe of pronotum almost straight and vertical in dorsal view, meeting the hind margin in an obtuse angle, not continued on to the epimeron in lateral view.
Ph. cassandra (Text-figs. 6, 7) and *Ph. polyxena* (not distinguished). Pages 25, 26 and 28.

BB. Sides of hind lobe of pronotum convex and rounded in antero-dorsal view.

C. Hind margin of hind pronotal lobe not continued on the epimeron; apex of wings not dark brown.

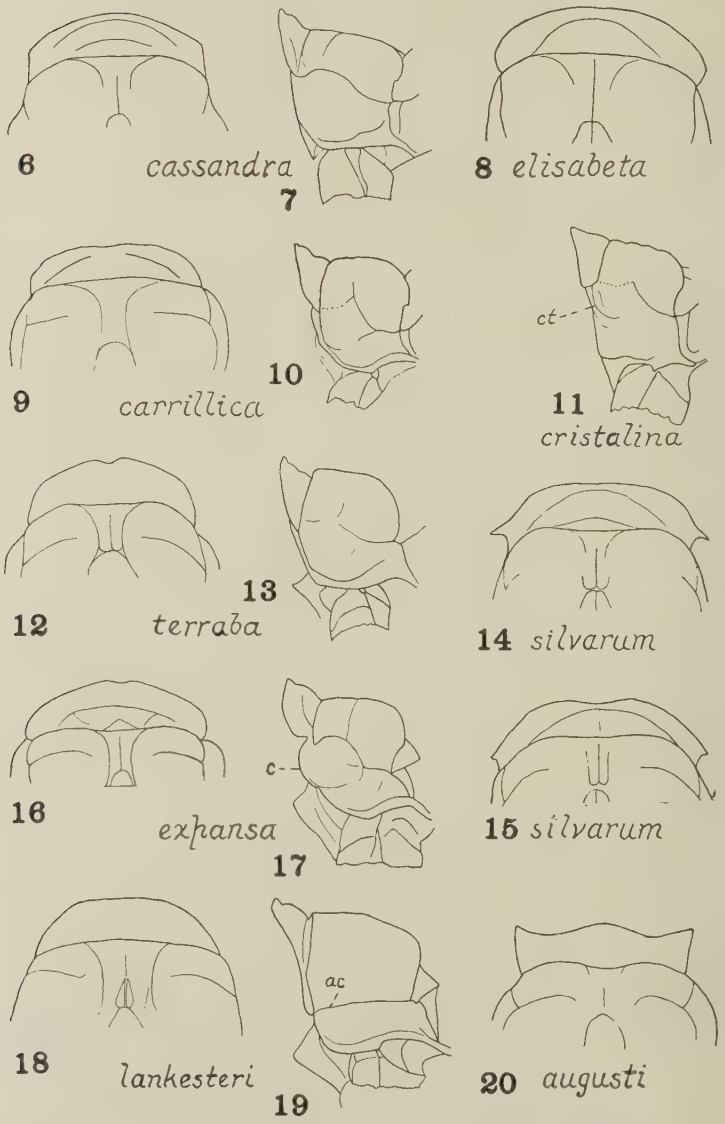
D. Hind margin of proepimeron in lateral view not concealed by any convex production of the sclerite itself.
Ph. carrillica (Text-figs. 9, 10). Page 45.
Ph. terraba (Text-figs. 12, 13). Page 52.
(Not distinguished.)

DD. Hind margin of proepimeron in lateral view concealed by a strongly convex production of the sclerite extending caudad.
Ph. expansa (Text-figs. 16, 17). Page 50.

CC. Hind margin of hind pronotal lobe continued on the epimeron.

E. Wings uncolored or narrowly brown at apex for not more than three cells in depth.

F. The continuation of the hind margin mentioned under CC extends ventrad so as to apparently form also the hind margin of the epimeron for the upper half of this sclerite, the epimeron with a longitudinal suture lying distinctly more ventrad than in the other species.
Ph. lankesteri (Text-figs. 18, 19.) Page 51.



Figs. 6–20. Middle and hind lobes of the prothorax of females of *Philogenia*. In the lateral views the base of the right first coxa is included. Drawn by P. P. Calvert. Magnification about 15 diameters.

Detailed explanation of plate on opposite page.

FF. The continuation of the hind margin of the hind pronotal lobe is a short, cariniform tubercle lying distinctly anterior to the hind margin of the epimeron, which it does not conceal.
Ph. cristalina (Text-fig. 11). Page 35.

EE. Wings for their entire width dark brown from the distal end of the stigma distad, at least in adults; hind margin of pronotum extended ventrad so as to apparently form also the hind margin of the upper third of the epimeron.
Ph. elisabeta (Text-fig. 8). Page 29.

AA. Hind lobe of pronotum convex in antero-dorsal view, prolonged each side into an acute-angled process which is directed laterad. *Ph. silvarum* (Text-figs. 14, 15). Page 38.

AAA. Hind lobe of pronotum bisinuate in antero-dorsal view, with lateral angles directed dorsad.
Ph. augusti (Text-fig. 20). Page 42.

The females corresponding to the males here described as *Ph. helena, umbrosa, schmidti, margarita, raphaella, berenice* and *championi* have not been recognized.

Figs. 6, 7. *Ph. cassandra*, San Esteban, Venezuela, Feb. 9, antero-dorsa and right lateral views.

Fig. 8. *Ph. elisabeta*, Colonia de Perené, Peru, June 20, antero-dorsal view.

Figs. 9, 10. *Ph. carrillica*, Carrillo, Costa Rica, antero-dorsal and right lateral views.

Fig. 11. *Ph. cristalina*, Cristalina, Colombia, Feb. 12, right lateral view; *ct*, cariniform tubercle of the proepimeron continuing the hind margin of the pronotum ventrad.

Figs. 12, 13. *Ph. terraba*, Rio Surubres, Costa Rica, Oct. 18, antero-dorsal and right lateral views.

Figs. 14, 15. *Ph. silvarum*, Colonia del Perené, Peru, June 18, antero-dorsal views of two individuals.

Figs. 16, 17. *Ph. expansa*, Rio Azul, Costa Rica, July 27, antero-dorsal and right lateral views; *c*, convex production of proepimeron which hides the posterior margin of the sclerite.

Figs. 18, 19. *Ph. lankesteri*, Cachí, Costa Rica, Oct. 2, antero-dorsal and right lateral views; *ac*, additional longitudinal suture of the proepimeron.

Fig. 20. *Ph. augusti*, Porto Bello, Panama, April 19, antero-dorsal view.

The Species of Philogenia

Philogenia helena (Plate I, figs. 21–24 (apps. ♂).)

Philogenia helena Hagen, Stett. Ent. Zeit., xxx, p. 261, 1869, (Bogotá, 2 ♂). Selys, Mem. Couron. Acad. Belg., xxxviii, p. 35, 1886, (Bogotá, ♂ ♀). Ris, Archiv Naturges., 82 jahrg. abt. A, 9 heft, p. 78, 1918, (Colombia: 1 ♂ 1 ♀, Gramal bei Muzo 700 m. X. 1910; 1 ♂, Pacho, 1500 m. IX. 1910.—Peru: 1 ♂, Chanchamayo).

Material examined: Hagen's paratype, 1 ♂, Sta. Fé de Bogotá, Lindig, 1862, from the Mus. Comp. Zool., Cambridge, Mass. Colombia, 1 ♂, from the Carnegie Museum, Pittsburgh, Pa. Total, 2 ♂.

Of the two males which Hagen used when describing this species, the older one is to be regarded as the type, as it is mentioned first and described in much more detail than the "Mas junior," which receives eleven words only, at the end of the description. This older male is in the Museum of Comparative Zoology, Cambridge, Massachusetts. Hagen wrote of it: "Alis hyalinis, summo apice fascia fusca, dimidio fere apicali antico subniveis." I have not examined it personally, but Mr. Nathan Banks has kindly done so for me and writes: "In the fore wing the black begins at about middle of stigma, in hind wing at apical third of stigma, in both nearly straight across."

Mr. Banks has compared its appendages with photographs of our figures 21, 22 and 24, Plate I, and I have studied drawings of its appendages made for me by Mr. J. H. Emerton. The inferior appendages, as shown in Mr. Emerton's drawings, do not agree with Hagen's description of them as to the "ramo externo lineari, semicirculari, apice dilatato, truncato," a phrase which applies well to our figure 24. I had thought that perhaps the "ramus externus" of both inferior appendages had been broken off but Mr. Banks writes: "There is no evidence that the process of lower appendage has been broken off, both are just alike. But! I have another theory. The last four segments of this male are glued to the abdomen so that the tip with genitalia may not belong to the bug. Next to it in the drawer is *P. cassandra* which also has the abdomen broken off at same point and nothing glued on. Are these appendages those of *P. cassandra* and the broken tip glued to the wrong insect?"

Mr. Emerton's drawings and some sketches by Mr. Banks certainly resemble the appendages of *Ph. cassandra* more closely than our figures 21, 22 and 24 and, although certain characteristic

features of the inferior appendages of *cassandra* are lacking, I believe that we may accept at least this much of Mr. Banks' suggestion, viz. that the broken tip of another insect has been wrongly glued to the anterior portion of the actual type of *helena*.

A male labeled "St. Fe de Bogota Lindig 1862," in Hagen's handwriting, also belonging to the Museum of Comparative Zoölogy, is before me and is, doubtless, the "mas junior" cited by Hagen and therefore a paratype. Its thorax, first six abdominal segments and wings (which have all the veins pale brown and no trace of dark markings in any part—Hagen wrote: "alis hyalinis, fascia apicali nulla") present the appearance of a teneral individual, yet the last three abdominal segments are distinctly pruinose dorsally. Most of the abdomen has been compressed, probably immediately after capture, the apices of the superior appendages and of the left inferior appendage have been broken off, but what remains and especially the characteristic tip of the right inferior appendage agrees with figures 21–24 in our Plate I.

The thorax is blackish-brown with a pale yellowish (blue or green in life?) stripe on each side of the mid-dorsal carina, on humeral, first and second lateral sutures and on the inferior margin of the metepimeron, the last named sclerite being predominantly yellowish with a cuneiform blackish-brown stripe in its center narrower ventrad.

Abdomen ca. 48 mm.; hind wing 44 mm.; stigma, front wing 2.96 mm.,[21] surmounting eight cells (right) or eight cells + part of one other (left); stigma, hind wing 3.26 mm., surmounting seven cells and parts of two others (r), eight + one (l); postnodals, front wing, forty-one, hind wing, thirty-four (r), thirty-six (l). Hagen wrote: "36 41 postcubitalibus. . . .Pterostigma 3 mill."

A male in the Carnegie Museum, Pittsburgh, lacking abdominal segments seven to ten, labeled "Colombia," may be *helena*. It has abdominal segments one to six = 36 mm., hind wing 41.5 mm.; stigma, front wing 2.81 mm., surmounting seven + two (r), seven + one (l) cells; stigma, hind wing, 3.03 mm., sur-

[21] Here and elsewhere in this paper it is the costal edge of the stigma whose measurement is given.

mounting six + two (r), seven + two (l) cells; postnodals, front wing, thirty-five (r), thirty-eight (l), hind wing, thirty-five. The wings are brown at the tips from the distal end of the stigma, proximal edge of the brown nearly straight. For the prothorax see *posteá* under *Ph. raphaella.*

M. Severin wrote that the specimen in the Musée Royale d'Histoire Naturelle at Brussels from which M. Menger drew our figures 21, 22 and 24, Plate I, is labeled "'Bogota' de la main de Selys, 'Philogena Walthera' de la main de Selys; dans le coll. il y a 11 exemplaires venant tous de Bogota." The name *Walthera* was never published, and there seems to be no reason to doubt that these, or some of these, specimens were those described by de Selys in 1886.

For a note on the prothorax of these two males of *helena*, see under *Ph. raphaella, posteá*, page 33.

Philogenia umbrosa (Plate II, figs. 44, 45 (apps. ♂).)

Philogenia umbrosa Ris, Archiv f. Naturgeschichte, 82 jahrg., abt. A, 9 heft, pp. 77, 78, fig. 33 (apps. ♂), 1918, (Peru: Pozuzo, 1 ♂).

No specimens of this species have been seen by me.

Philogenia cassandra (Text-figs. 4, page 10 (penis), 6 and 7, page 18 (prothorax ♀); Plate I, figs. 25–28 (apps. ♂)[22]; Pl. III, figs. 52–54 (prothorax ♂).

Philogenia cassandra Hagen, Bull. Acad. Roy. Belg., (2), XIV, p. 12, 1862, (Venezuela, Porto Cabello (par Appun) Mus. de Vienne et Coll. Hagen, Selys).

Selys, Mem. Couron. Acad. Roy. Belg., XXXVIII, p. 38, 1886, (Puerto Cabello (Colombie[23]),—S. Esteban (Venezuela). Coll. Selys, etc.).

Calvert, Biol. Cent.-Am., Neur., tab. v, fig. 10 (apps. ♂), 1901.

Material examined: One male "Venezuela Schneider," one immature female "Venezuela Appun 2," both labels in Hagen's handwriting, Mus. Comp. Zool.

VENEZUELA: San Esteban, Carabobo, Feb. 1, 2, 4–9, 1920, 136 ♂, 18 ♀, Bejuma, Carabobo, Feb. 14 and 17, 1920, 17 ♂; between Bejuma and Caserio Silva, Feb. 22, 1920, 1 ♂, 1 ♀; Nirgua Yaracuy, Feb. 27, 1920, 1 ♂, 1 ♀; in San Felipe basin, March 1, 1920, 2 ♂. J. H. and E. B. Williamson and W. H. Ditzler, collectors. Collection of E. B. Williamson.

Total: 158 males, 21 females.

[22] M. Severin states that our figures 25, 26 and 28 were made from a specimen in the Museum at Brussels with the labels "'San Esteban Venezuela' de la main de Selys [&] 'Philog. cassandra' de la main de Selys" and adds "dans la coll. il y a 2 ex. de Venezuela 1 ex. de San Esteban, Venezuela."

[23] Probable error for Venezuela, see the first citation.

Mr. Williamson has described the localities at which his collection was made.[24] From his account we quote the altitudes: San Esteban, 0–3000 feet; Bejuma, Caserio Silva and Nirgua each 1500–2000 ft.; San Felipe 745 ft., and that Bejuma and Caserio Silva are in the Orinoco drainage, while the others are in that of the Caribbean coast.

♂. The male by Schneider is the original of the only figure of this species hitherto published (1901). As compared with our present fig. 26, Plate I, it has the proximal of the two slender curved spines on the dorsal surface of each inferior appendage less developed on the right appendage, and the distal of these spines is shorter and less produced on both.

Abdomen 40.5, hind wing 34 mm. Pterostigma, costal edge 2.4 (front), 2.2 (hind) mm., surmounting one + part of one other cell (right front wing), one + parts of two other cells (rh), two + parts of two others (lf), two + part of one other cell (lh); one of the cells wholly or partly surmounted is always much larger than any of the nearby cells (the same is true for the three remaining wings of Appun's female).

Legs yellowish, apices of the femora narrowly (.4 mm.) blackish, a brown line on the ventral surface of the first tibia only.

The same differences from our figure 26 of the appendages noted above as existing in the distal spine of the inferior appendages of Schneider's male, are also to be found in some of the series from Venezuela in Mr. Williamson's collection, *e. g.*, from San Esteban.

Head—colored as described for *carrillica* ♂ except that the black does not show a metallic green reflection and that the median labial lobe, instead of being entirely black, has an elliptical, median, black spot for its entire length and its lateral margins narrowly yellow.

The original and only description of the colors of *cassandra* reads:

Crête dorsale du thorax noire, finement bordée de jaunâtre; le reste du devant du thorax et des côtés brun foncé avec une ligne humérale, deux latérales et les dessous jaunâtre livide.

[24] Occasional Papers of the Museum of Zoology, University of Michigan, no. 130, pp. 21–46, 1923.

Abdomen brun foncé avec un anneau basal jaunâtre aux 3-7e segments.

Schneider's male is probably discolored on the thoracic dorsum, being brown somewhat streaked with yellowish, but the sides of the thorax are predominantly pale yellowish with blackish brown covering almost the entire mesinfraepisternum (except its postero-inferior angle) and the lowest fourth of the mesepimeron for the anterior two-thirds of its width; a black stripe, of varying width, borders the metepisternal side of the second lateral suture for its entire length, but at no point does it attain the site of the subobsolete first lateral suture, its greatest width occurring just above the metastigma. The upper part of the mesepimeron is faintly brownish, the upper part of the metepimeron a darker brown, but the anterior margins of both these sclerites, the posterior margin of the former, the ventral margin of the latter, as well as the entire pectus, are pale yellow. Abdominal segment two has an ill-defined yellowish longitudinal stripe each side and the yellow ring on the base of segment three is prolonged on each lateral surface as a narrow stripe or line for three-fourths of the segment's length.

Similar coloration exists in the series from Venezuela taken by Messrs. J. H. and E. B. Williamson and W. H. Ditzler. The variations observed therein are in:

The extent and degree of shade of the dark brown on the mesepisterna: in its most reduced condition it is confined to the outer half of the sclerite and to a superior transverse band connecting this with the mid-dorsal carina where the carina forks but leaving the extreme postero-superior angle of the mesepisternum yellow (*e. g.*, San Esteban 1 ♂, Bejuma 1 ♂, between Bejuma and Caserio Silva 1 ♂, S. Felipe basin 1 ♂), while, in the other male from the last-named locality, the brown covers the sclerite except for the narrow yellow line bordering the mid-dorsal carina and a small yellow patch at the posterior and anterior lateral angles respectively; this male may be a little older than its companion judging from the greater pruinosity at the apex of the abdomen.

The brown on the upper part of the mesepimeron may be distinctly continuous, although paler, with the black of the lowest fourth of the sclerite, especially posteriorly.

The brown on the upper part of the metepimeron is always darkest at the extreme hind end of the sclerite but is very indefinite elsewhere in its boundary.

A lateral yellow line or narrow stripe is sometimes seen on abdominal segment four, similar to that on three (*e. g.*, Bejuma ♂).

The most constant features of the coloration of the thorax are the following black or blackish-brown areas: the proepimeron, the mid-dorsal carina, the elliptical spot, .5 mm. long, occupying the shallow depression near the upper end of the humeral suture and which is prolonged as a line for a varying distance downward along the suture; the mesinfraepisternum and the adjoining spot on the lowest fourth of the mesepimeron; the complete stripe along the hind margin of the metepisternum and the hind margin (or a little more) of the metepimeron; this last, however, is very narrow in many individuals and then not more prominent than the black superior margins of the mesepimeron and metepisternum.

♀. Head colored dorsally as in the male; labrum chiefly black,[25] its base and its free margin narrowly yellow or pale green; median labial lobe as in the male, lateral lobes black, mentum and stipites yellow; black markings of the lower surface of the head but faintly indicated in a teneral female from San Esteban.

The coloration of this sex is nearly the same as in the male but, in most of the individuals examined, is more obscure. The pruinosity so frequent on the dorsum of the apex of the abdomen of the males (hind part or none of eight, all or most of nine and ten) is absent in the females, however; instead, there may be a pair of pale (blue ?) spots, confluent in some individuals, occupying the anterior three-fifths, or all, of the dorsum of nine;[26] seven females (San Esteban) have a pair of triangular pale spots on the posterior two-thirds of the dorsum of eight, confluent medially (or

[25] Except in the Nirgua female, in which the labrum is chiefly greenish yellow with an ill-defined blackish transverse stripe at mid-length connected by a short median longitudinal stripe to the base of the sclerite.

[26] A pair of pale spots is visible here in some males which may have even some slight pruinosity on the apex of the abdomen and at the bases of the legs (*e. g.*, San Esteban, Feb. 7).

not confluent, two of the seven) at the hind end of the segment; three of these seven have also a pair of pale spots on the dorsum of ten; another female from San Esteban (not of these seven) and that from between Bejuma and Caserio Silva have much of the dorsum of eight and of ten pale. Two of the seven females mentioned have pruinosity on mesepimeron, metapleuron, pectus and coxae of all three legs, but not on the abdomen. Abdominal segments four to seven may have a yellow lateral line, or narrow stripe, similar to that on three.

♂, ♀. The hind lobe of the pronotum of the males has an acute process on each side; this process appears to be more slender and directed more downward (ventrad) in the males from Bejuma, between Bejuma and Caserio Silva, Nirgua and the San Felipe basin than in those from San Esteban, in which latter the extreme apex of the process is bent slightly upward (dorsad). One male from Bejuma, however, approaches those from San Esteban (*cf.* Plate III, figs. 52–54). In the females this lateral process is lacking; the sides of the hind lobe are straight and meet the hind margin at an obtuse angle (*cf.* page 18, fig. 6).

Dimensions, etc. ♂. Measurements of ten males (three San Esteban, three Bejuma, one between Bejuma and Caserio Silva, one Nirgua, two San Felipe basin) give the following results: Abdomen, 37.5 (Nirgua)—42.5 (S. Est., betw. B. & C. S.), average 40.75 mm. Hind wing, 30 (Nirgua)—35 (S. Est. & betw. B. & C. S.), average 33 mm. Stigma, front wings: 1.9 (Bejuma)—2.3 (S. Est.), average 2.1 mm., surmounting three + one to five cells, four most frequently. Stigma, hind wings: 2.0 (Nirgua)—2.44 (S. Est.), average 2.2 mm., surmounting two + two to five cells, four + one most frequently. Postnodals, front wings: 21 to 26, average 23; hind wings, 20 to 24, average 21.9. Other individuals gave a greater range to certain dimensions, viz.: abdomen, 35 (S. Est.)—45.5 (Bejuma), hind wing, 28 (S. Est.)—36.5 (Bejuma).

♀. Measurements of ten females (eight S. Esteban, one betw. Bejuma and Caserio Silva, one Nirgua) give the following: Abdomen: 34.5–41 (betw. B. & C. S.), average 36.3 mm. Hind wing: 29.5 (S. Est.)—35 (betw. B. & C. S.), average 32 mm. Stigma, front wings: 1.85 (S. Est.)—2.3 (do.), average 2.07 mm., surmounting three + one to four + one cells, four + one most frequently. Stigma, hind wings: 2.0 (S. Est.)—2.44 (do.), average 2.2 mm., surmounting three + one to five cells, three + two and four + one equally frequent (five out of twenty

wings each). Postnodals, front wings: 21–26, average 23.7; hind wings: 20–26, average 21.9.

The expressions, "three + one," "two + two," as indicating the number of cells surmounted by the stigma, here and elsewhere in this paper, mean three cells plus part of one other cell, two cells plus parts of two other cells, etc.

Habits.—On the envelope containing two males from San Esteban, Feb. 9, 1920, Mr. Williamson has written this note: "Dance head on rarely like *Heteragrion* one passing above the other. Male holds female entirely by hind lobe of [her prothorax, [his] superiors behind inferiors above. Active till 4 P. M. Not seen ovipositing."

Food.—The space between the appendages of one male from San Esteban, Feb. 9, 1920, was filled with a mass of excrement. Teased in distilled water and examined under a compound microscope, this was found to contain many chitinous fragments, some of them bits of compound eyes, some of them pieces of legs bearing numerous hairs, but none of them sufficiently preserved to admit of more precise identification.

Philogenia polyxena new species (Plate I, figs. 30, 31 (apps. ♂).)

Material examined: VENEZUELA, Aroa in Yaracuy state, March 14, 1920, one pair ♂ ♀, three other ♂, one ♀. J. H. and E. B. Williamson and W. H. Ditzler. Total: 4 ♂, 2 ♀. Collection of E. B. Williamson.

Type: one of these males figured on Plate I, figs. 30, 31. The altitude of Aroa is 700 feet.[27]

♂. Very similar to *Ph. cassandra* from which it differs chiefly in the inferior appendages, which have the distal "spine" of the dorsal surface much shorter, barely visible in profile view, lying nearly in the same (horizontal) plane as the terminal part of the appendage itself, blunt instead of acute at tip; lateral margin of each appendage as seen in profile almost straight, not bent, barely sinuous, while in *cassandra* the same margin is slightly bent at two-fifths its length, the terminal three-fifths slightly curved so as to be concave dorsad; in ventral view the distal "spine" is broadly truncated and lies distinctly more laterad than in *cassandra*, occupying the middle of the apical margin of the appendage, while in *cassandra* it forms the mesal apical angle, process of the lateral apical angle more slender and more acute than in *cassandra*.

[27] Williamson, Occas. Papers Mus. Zool. Univ. Mich., no 130, p. 22, (1923).

The smallest male has a pair of pale spots on the nasus and the basal yellow of abdominal segments five to seven is continued as an ill-defined brownish lateral streak for the greater part of the length of each of these segments.

♀. Similar to, if not identical with, the female of *cassandra*. One female has abdominal segment nine with a pair of pale spots on the anterior three-fifths of the dorsum; the other has most of the dorsum of nine pale, dorsum of eight with an indistinct pale spot each side.

Dimensions, etc. Abdomen: ♂, 40.5–45, average 42 mm.; ♀, 36, 39 mm. Hind wing: ♂, 32–35, average 33.5 mm.; ♀, 30, 34 mm. Stigma, front wings: ♂, 2.15–2.4, average 2.2 mm.; ♀, 2.07, 2.22 mm., surmounting, ♂, three + two to five cells, four + two most frequently; ♀, four, four + one. Stigma, hind wings: ♂, 2.15–2.52, average 2.3 mm.; ♀, 2.22, 2.59 mm.; surmounting, ♂, three + two to four + one cells, four + one most frequently; ♀, three + one to four + one cells. Postnodals, front wings: ♂, 23–26, average 24.25; ♀, 21–26, average 23.8; hind wings: ♂, 21–25, average 22.9; ♀, 21–25, average 22.5.

As this species so closely resembles *P. cassandra*, it seems appropriate to give it the name of a sister of that unfortunate seeress.

Philogenia schmidti (Text-fig. 2, page 10 (penis); Pl. I, figs. 29 (prothorax ♂), 32–35 (apps. ♂).)

Philogenia sp. Schmidt, Zool. Jahrb., Abt. Anat. Ontog., xxxix, pp. 91, 147, taf. 11, fig. 62 (apex of penis), (1915).

Philogenia schmidti Ris, Archiv f. Naturges. 82 jahrg. abt. A, pp. 77, 79, fig. 34 (apps. ♂), taf. II, fig. 35 (wings, venation), (1918), [Bolivia: 11 ♂, 4 ♀ Rio Songo 750, 800, 1000 m., 1912/13; 4 ♂, 4 ♀ Coroico 1000–1400 m., 1913.]

Material examined: One male, nine miles Northeast of Coroico, Bolivia,[28] May 26, 1899, taken by W. J. Gerhard. Academy of Natural Sciences of Philadelphia.

This specimen is well matured, metepimeron and metasternum shining black with much bluish pruinosity, but no pruinosity

[28] The map of the La Paz district of Bolivia, published by the American Geographical Society of New York in 1922, shows Coroico on the Rio Coroico, about 55 km. northeast of La Paz and gives its altitude as 1725 m. The locality "nine miles north east of Coroico" would not, according to this map, differ very greatly in elevation. The Rio Coroico belongs to the system of the Rio Beni. Mr. Gerhard's brief account of his collecting near Coroico is given on pages 22–23 of A. G. Weeks' "Illustrations of Diurnal Lepidoptera," Boston, Printed by The University Press, 1905.

on the black terminal abdominal segments. Pterostigma, costal edge 1.70 (front wing), 1.93 (hind) mm. long, surmounting four cells and a small part of one other, no one cell markedly longer than its neighbors.

Philogenia elisabeta new species (Text-fig. 8, page 18 (prothorax ♀); Pl. II, figs. 39–42 (apps. ♂), 43 (prothorax ♂).)

Material examined: Peru: Colonia del Perené, Campamiento, June 19–21, 1920, 4 ♂, 1 ♀. Messrs. Dr. W. T. M. Forbes, J. H. Williamson, Dr. J. C. Bradley, collectors. Collection of E. B. Williamson.

Type: one male of June 19, figured on Plate II, figs. 39–43.

Mr. Williamson states[29] that Colonia del Perené is on the Rio Perené, Department of Junin, and that its elevation is 2230 feet.

♂. Dorsal surface of the head blackish brown with no metallic reflection, a dull yellowish brown stripe from eye to eye, behind the antennae, including the area between and adjacent to the three ocelli, and bounded posteriorly by a sinuous black line; posterior to this black line adjacent to each eye is a triangular yellowish brown spot. Antennae dark brown, but much of the first two joints pale. Labium and stipites brownish yellow, lateral labial lobes and a central elliptical spot on the median lobe black.

Pronotum and mesepisterna brown, sides of meso- and metathorax paler brown, the following black in addition to those mentioned on page 6: procpimera, an ill-defined, cuneiform, antehumeral stripe, absent in one of the four examples while another is sufficiently discolored as to make the form of the stripe uncertain, on the upper four-fifths of the mesepisternum, tapering to a point inferiorly, a few dots on the humeral suture below the depressed spot, a stripe on the mesepimeron continuous with the black of the mesinfraepisternum, upper half of the metinfraepisternum continuous with the stripe along the posterior margin of the metepisternum, the stripe on the metepimeron distinctly nearer to its ventral than to its anterosuperior margin.

Abdomen: a longitudinal yellow stripe each side on segments one and two for almost the entire length of each segment, on three for the anterior three-fourths.

Pruinosity present, variable in extent, on the coxae, pro-, meso- and metapleura, wing bases, metasternum, ventral surfaces of abdominal segments one, three to eight, sides of one and two, dorsal surfaces of one, eight to ten and on the appendages.

[29] Occasional Papers, Mus. Zool. Univ. Mich., no. 130, p. 28, (1923).

Superior abdominal appendages 1.9–2.2 mm. long, about three times as long as segment ten (.7 mm.), black. In dorsal view: enlarged on the inner (mesal) margin, in the third and fourth fifths of their length, to twice their preceding width in a strong convexity whose summit is truncated to present a straight edge subparallel to the corresponding part of the opposing appendage; terminal fifth much narrower, tapering to the rounded obtuse apex which is slightly hooked mesad. In profile view: gradually decreasing in thickness from base to apex which is obtuse and rounded, curved ventrad at about mid-length, where it shows a stout, triangular, inferior tooth, not longer than the thickness of the appendage itself, formed by the mesal edge of the convex enlargement above mentioned being bent ventrad.

Inferior appendages black, in profile view: 1.1–1.3 mm. long, markedly decreasing in thickness from base to apex, ventral edge showing two gentle convexities separated by a gentle concavity near or beyond mid-length; dorsal margin with a rounded tubercle immediately after the base and an almost erect conical tooth at two-thirds length, this tooth shorter and less acute than the remaining third of the appendage which tapers gradually to the acute slightly upcurved apex. In ventral view: each appendage decreasing in width to mid-length, apical half much narrower, slender, subparallel[30] to its fellow of the opposite side, tapering to the acute apex; the rounded postbasal tubercle of the profile view is seen as a well-marked prominence from the lateral margin, but the tooth at two-thirds length is concealed.

Wings clear or dirty brownish yellow, apices dark brown for a length of 3.5–4 mm., beginning under the middle of the stigma, proximal edge of this brown slightly convex.

♀. Differs from the male as follows:

Black of the dorsal surface of the head replaced by blackish brown, only the two extremities, right and left, of the sinuous black line present. Labrum blackish brown, its margins soiled greenish, external surface of the mandibles and adjoining part of the genae soiled greenish.

No antehumeral black stripe, no black dots below the spot on the depression of the humeral suture.

Yellow lateral stripe on abdominal three reaching to four-fifths of the segment's length, a similar stripe on segments four to six, that on six reaching only to mid-length of the segment. Dorsal surface of eight and nine pale, outlines ill-defined.

Pruinosity present on the ventral surface of thorax and abdominal segments one to six, coxae, pro- and metapleura, and wing bases.

[30] Here, as in other species, defaecation causes the inferior appendages to diverge.

Abdominal appendages .7 mm. long, longer than segment ten (.4 mm.) conical, black.

Wings very faintly tinged with brown, brown at the apex of front wings only 2 mm. long, on the hind 2.75 mm. long, on all beginning at the distal end of the stigma, its proximal edge straight.

Dimensions (in mm.), etc. (4 ♂, 1 ♀). Abdomen: ♂, 47–50.5, average 49; ♀, 44. Hind wing: ♂, 40.5–42, average 40.9; ♀, 42. Stigma, front wings: ♂, 2.81–2.96, average 2.9, surmounting from five cells and part of one other to seven cells and part of one other, five + one and six + one equally frequent; ♀, 3.26, surmounting six cells and part of one other. Stigma, hind wings: ♂, 3.03-3.26, average 3.14, surmounting from five cells and part of one other to six cells and parts of two others, six + two most frequent; ♀, 3.4, surmounting six (right) or five cells and parts of two others (left). Postnodal cross-veins, front wings: ♂, 28–31, average 29.5, no one number most frequent; ♀, 29 (right), 26 (left). Id., hind wings: ♂, 25–30, average 27.4, 28 most frequent; ♀, 23 (right), 26 (left).

Elisabeta closely resembles *margarita* Selys, the differences being given in the key, page 15, *anteà*. Its specific name is suggested by that of the companion of Gretchen at the well in Goethe's *Faust*.

Philogenia margarita (Pl. II, figs. 36, 37 (apps. ♂).)

Philogenia margarita Selys, Bull. Acad. Belg., (2), XIV, p. 11, (1862), (L'Amazone, par M. Bates. Collect. Selys ♀).

Selys, Mem. Couron. Acad. Belg., XXXVIII, pp. 38, 37, 1886, (Teffé (Amazone supérieur) par M. Bates. Coll. Selys).

No specimen of this species has been seen by me.

M. Severin states that our figures were drawn from a specimen in the Brussels Museum bearing the labels, "'170 Ophryopus teffensis B.' l'etiquette pas de la main de de Selys [and] 'Philog. margarita' de la main de Selys." He adds, "dans la coll. Selys ♂ et ♀ avec le chiffre 170 (je suppose provenant d'un envoi de Burmeister ?) et un 3. ex. avec Amazon de la main de Hagen."

It would seem more likely that the "B." is for Bates rather than Burmeister.

Philogenia raphaella (Pl. III, figs. 50, 51 (apps. ♂); text-fig. 5, page 10 (penis).)

Philogenia raphaella Selys, Mem. Couron. Acad. Roy. Belg., XXXVIII, p. 37, 1886, [Bogotá. Un mâle unique; Coll. MacLachlan].

Material examined: 2 imperfect ♂, Bogotá, noted below, may belong here.

In order to determine exactly what are the characters of the appendages of the type of *raphaella*, I applied to Mr. Herbert Campion of the British Museum (Natural History). After receiving my communication, Mr. Campion asked Mr. C. L. Withycombe to assist us because he learned that Mr. Withycombe was about to consult the McLachlan Collection in regard to another matter. Mr. Withycombe took with him photographs of the present figures 46 and 47 of *Ph. berenice*, made the drawings shown in our figures 50 and 51, Plate III, and the following notes: "The type [of *raphaella*] appears to differ from wash drawing mainly in the sharper and straighter ventral appendages A and in the prominence at B. The superior appendages are rather similar but are perhaps a little more expanded distally in the type than in wash drawing. I am not much conversant with the Odonata, my own group being mainly Neuroptera (Planipennia) but from what I saw of the genitalia of the type *P. raphaella* I should certainly consider it to be distinct specifically from that of your wash drawing. The drawings here made are outlines with a camera lucida. The room was not very light and the abdomen being bent under, almost to touch the thorax, rendered manipulation difficult."

In the Carnegie Museum, Pittsburgh, is a male, labeled "Bogota," which may belong to this species. Abdominal segments four to ten are lacking, one to three measure 12 mm., hind wing, 36.5. Postnodals, front wing: 31 (right), 33 (left); hind wings, 28 (r), 30 (l). Stigma of front wings, costal edge: 2.52 mm., surmounting six cells and parts of one other (right), seven + two cells (left); of hind wings, 2.81 mm., surmounting six + two (r), seven (l) cells. Tips of the wings brown, proximal edge of the brown nearly straight, at distal end of stigma.

A male lacking the last eight abdominal segments given to me in 1896 by Herr E. Suffert, of Berlin, as from Bogotá, also may belong here. It has hind wing 38.5 mm. Postnodals, front wings: 32 (r), 33 (l); hind wings, 26 (r), 28 (l). Stigma, front wings: 2.59 mm., surmounting six + two (r), seven (l) cells; of hind wings, 2.96 mm., surmounting six + two (r), six + one (l) cells. Tips of all the wings, from about the distal third of the stigma distad, dark brown, proximal edge of the brown tending to be concave.

These two specimens, which at first I had considered to be *helena*, are now referred here because of their smaller size (hind wing, *helena* types, ♂, 39–47 mm., *raphaella* type, ♂, 35 mm.) and fewer postnodals, front wings (*helena* types, ♂, 36–41, *raphaella* type, ♂, 30).

These two males, Hagen's paratype of *helena* and the Colombia male described *anteà*, page 21, under *helena*, have the hind lobe of the pronotum convex, not angulated at the sides, not quite as wide in dorsal view as the median lobe, similar to our figure 43, plate II, of *elisabeta*, but the hind margin is a little flatter in the middle.

Philogenia berenice (Pl. III, figs. 46–49 (apps. ♂).)

Philogenia berenice Hag. [MS.], Higgins, Proc. Acad. Nat. Sci. Phila., 1901, p. 136, [Equitos, Peru; gizzard only described].

Material examined: Iquitos, Peru, Staudinger, two males in the Museum of Comparative Zoölogy, Cambridge, Massachusetts. The smaller of these is that whose gizzard was described by Miss Higgins and is therefore the type.

As this species is apparently close to *raphaella* Selys by its appendages and as no undoubted specimens of this latter have been seen by me, the following description of *berenice* follows the order of Selys' description of *raphaella*.

♂. Abdomen, 39–41; hind wing, 32.5–33 mm.

Wings hyaline, apices from the distal end of the stigma narrowly edged with pale brown whose proximal edge is concave and whose maximum width is .74 mm. on the front and 1.1 mm. on the hind pair. Stigma ocher-brown, its costal edge 2.44 mm. (front wings), 2.67 mm. (hind) long, surmounting five and part of one other cells to six and part of one other cells, except in the left front wing of the paratype, where three and parts of two other cells are surmounted, and this is the only one of the eight wings in which one of the surmounted cells is markedly longer than any of its neighbors. Twenty-five to thirty postcubitals on both front and hind wings.

Blackish brown marked with obscure yellowish as follows: mentum and margins of other sclerites of the labium, most of the rear of the head except immediately bordering the eyes superiorly, a subquadrate spot laterad to each lateral ocellus (and in the paratype a subtriangular spot laterad to the preceding spot and applied against the eye-margin—the two spots representing the ocellus to eye stripe characteristic of the genus), second joint of antenna except at apex and (more obscure) much

of the slenderer third joint, a spot on each side of the middle and hind lobes of the pronotum, an indistinct line or narrow stripe on each side of the black mid-dorsal thoracic carina, an indistinct stripe on the humeral suture, widest (.7 mm. or less) below mid-height, a narrow stripe (.2 mm.) on the obsolete first lateral suture, continued, but not in the same line and wider, on to the mesinfraepisternum; a stripe of about the same width (.2 mm.) on the second lateral suture (metepisternum, metepimeron otherwise, and pectus shining black, all three with some scattered pruinosity), much of the sides of abdominal segment one, a narrow (.3 mm.), longitudinal lateral stripe on two, a transverse basal ring on three to seven, an elongated lateral spot in the third quarter of three to five (or six), connected with the basal ring on three only. Segments eight to ten black, mostly pruinose (type) or not pruinose (paratype) on dorsum. Labrum and lateral face of mandibles pale bluish-green.

Superior appendages, 1.11–1.18 mm. long, one and two-thirds times to twice as long as segment ten (.6–.67 mm.); in dorsal view forcipated especially in their distal halves, each of nearly uniform width in the proximal half, gradually widening in the distal half to the apex which is truncated nearly at right angles to the curved longitudinal axis of the appendage, angles of the truncation rounded off especially the lateral one. In profile view each appendage is bent ventrad and caudad at three-fourths' length, decreases in thickness from base to apex, dorsal margin slightly concave to about three-fourths' length, beyond that point almost straight, latero-ventral margin slightly convex to the same distance, then straight; the ventral process of the mesoventral margin corresponds in position to the mesal angle of the truncated apex of the dorsal view and in profile view projects ventrad below the latero-ventral margin by less than the thickness of the body of the appendage.

Inferior appendages reaching to one-half to three-fifths of the length of the superiors, in profile view decreasing rapidly in thickness from base to apex, dorsal margin nearly straight, ventral margin presenting two convex curves in succession, apex acute, curved slightly dorsad. In ventral view, the two appendages together are as wide at base as the distance between the lateral margins of the two superior appendages at base. Mesal margins of the two inferior appendages subparallel, straight to beyond mid-length, then slightly excised and beyond this convex; lateral margins straight, rapidly converging until opposite the excision of the mesal margins when they become subparallel to the mesal margins and continue as straight edges to the apex which is truncated almost at right angles.

Legs obscure yellowish, carinae of the femora, an inferior stripe except at the base on all three femora, an inferior stripe except at the base on all three tibiae, a superior stripe for the whole length of the first tibia, apices of all femora and of all tibiae blackish or blackish brown, tarsi, and femora superiorly in the middle of their length, brownish.

Our figures 46 and 47, Plate III, are from a specimen in the Brussels Museum and of it M. Severin has supplied the following information. "Exemplaire unique 'Iquitos Stgr.' cela veut dire Staudinger, etiq. de la main de Selys; 'irene?' une etiquette de la main de Selys; puis à coté de l'insecte une etiquette avec 'Philog. raphaella' de la main de Selys, tandisque la grande etiquette specifique en dessous de l'insecte porte de la main de Selys 'Philogenia raphaella Selys race de margarita Bogota—coll. McLachl.' "

The chief differences between this species and true *raphaella* are given in the key, *anteà*, page 16. There is, besides, the wide distance between their habitats: Iquitos, Peru, and Bogotá, Colombia, respectively.

Prothorax in antero-dorsal view similar to our fig. 43, plate II, for *Ph. elisabeta* ♂.

Philogenia cristalina new species (Text-fig. 11, page 18 (prothorax ♀); Plate IV, figs. 58–60, 64 (apps. ♂).)

Material examined: Cisneros, Colombia, February 10, 1917, 1 ♂. Cristalina, Colombia, Feb. 12, 18 ♂, 1 ♀, Feb. 16, 13 ♂, 2 ♀, Feb. 17, 12 ♂, Feb. 19, 2 ♂. Total, 46 ♂, 3 ♀. All taken in 1917 by Jesse H. and E. B. Williamson, now in the latter's collection.

Type, a male from Cristalina, Colombia, taken Feb. 12, the original of figures.

♂. Dorsal surface of head without metallic reflection, the dull pale (brown ?) straight stripe from each lateral ocellus to the adjacent eye bordered throughout its length by black which on the posterior side has the width of a line only as it nears the eye, where it separates the pale stripe from a triangular dull pale (brown ?) postocular spot immediately adjoining the eye; the black on the anterior side of the pale ocellus-to-eye stripe separates the latter from a narrower, similarly colored transverse sinuous stripe lying immediately in front of the median ocellus and barely reaching the base of each antenna. Labium and stipites dull yellowish brown, lateral labial lobes and a central elliptical spot on the median lobe black. Antennae black but much of the first two joints pale.

Pronotum and mesepisterna dull brown; proepimera, mes- and metinfraepisterna (except at the posterior inferior angle), a broad stripe on mesepimeron, one along the posterior margin of metepisternum and one on metepimeron black. The remainder of the sides of the thorax is pale brownish yellow, paler than the thoracic dorsum, and which forms a narrow stripe bordering the humeral suture posteriorly, a slightly wider stripe along the subobsolete first lateral suture (interpleural of Garman) and the margins of the metepimeron except at its posterior extremity.

Abdomen blackish, a longitudinal stripe on each side of segments one and two for their entire length, of three for its anterior half or more, of four in some for its anterior fourth.

In older individuals pruinosity appears on the sides and hind margin of the prothorax, on the sides and ventral surface of the thorax, at the bases of the wings, on the dorsal surface and sides of abdominal segment one, on the sides of two, and on the dorsum of eight (hind end only), nine and ten, and on the appendages.

Superior abdominal appendages, 1.3–1.4 mm. long, between two and three times as long as segment ten (.52–.6 mm.), black. In dorsal view, enlarged on the inner (mesal) side in the distal half to twice or more of its preceding width, opposed margins of the enlargement nearly straight and parallel, beyond which the appendage is truncated caudad and laterad, the extreme apex barely recurved. In profile view, bent downward at mid-length, gradually decreasing in thickness in the distal half to the rounded, obtuse apex, the enlargement of the mesal margin of the dorsal view not projecting below the external ventral edge and hence not visible in this view.

Inferior appendages of the same length as the superiors, black, in profile view rapidly decreasing in thickness in the proximal two-thirds of their length, the terminal third a slender, straight, sharp, nearly horizontal process; the ventral margin of the proximal two-thirds of the appendage forms two successive convexities, the proximal the longer, the dorsal margin shows a horizontally truncated tubercle near the appendage base followed by an abrupt constriction of a length greater than that of the tubercle, succeeded in turn by an erect conical spine at two-thirds the appendage length, where the terminal process begins. In ventral view each appendage narrows to three-fifths its length, at which point it is bent obliquely laterad and is then soon bent again caudad to form the slender, straight, terminal process which is parallel to or a little divergent from that of the opposite side; the apical margin of each inferior appendage is not at all bilobed as is the case in such species as *cassandra* and *polyxena*.

Wings clear, uncolored except for a narrow border of brown for a width of one to three cells at the apex from the stigma distad, or the entire wing yellow or pale brown, the apical border always darker.

Mr. Williamson made the following description of the living colors of the male taken at Cisneros, Feb. 10, 1917: Eyes above and in front black, extreme lower and hind part grayish brown. Face dark dull brown, upper lip and adjacent [parts] laterally bright grass green. Mesepisterna clove brown, an obscure narrow dull yellow humeral stripe, mesepimeron black; first lateral suture narrow, dull yellow, but brighter than humeral. Metathorax dull yellow brown, each sclerite with broad black stripe. Abdomen black, dull, two to seven with dull obscure greenish interrupted basal rings, apex of eight and nine and ten above pruinose white.

The prothorax in the two sexes of *cristalina* is very similar in antero-dorsal view, and resembles fig. 43, plate II, of that of *Ph. elisabeta* ♂.

♀. Differs from the male as follows:

Pale dull (brown ?) ocellus-to-eye stripe confluent with the similarly colored stripe lying in front of the median ocellus; area enclosed by the three ocelli and also that immediately behind the two lateral ocelli also pale dull (brown ?)—in two of the three examples; the third has the markings more obscure, perhaps as in the male. Traces of a pair of paler spots on the nasus. Labrum clouded in most of its surface but yellow near its proximal and distal margins. Lateral longitudinal pale yellowish stripe present on abdominal segments four to seven for the anterior third or fourth of each; eight with a pair of pale dorsal spots on the posterior half, dorsum of nine pale blue (?) except for a narrow transverse apical black stripe which connects the black of the two sides of the segment, ten with a narrow transverse pale (brown ?) stripe each side at base.

Pruinosity present on the proepimera, metapleura, metasternum, first abdominal sternite and coxae of all legs in all three examples.

Abdominal appendages .52 mm. long, subequal in length to segment ten, conical, black.

Wings uncolored, or slightly brownish, with apex narrowly brown as described for the male.

Measurements, etc. Ten males and three females gave the following: Abdomen: ♂, 38–49 mm., average 43.5; ♀, 36–39, average 37.3. Hind wing: ♂, 33–40, average 36.4; ♀, 33.5–38.5, average 36. Stigma, costal margin, front wings: ♂, 2.22–

2.74, average 2.41, surmounting from three cells and parts of two others to seven cells, five + parts of two and four + parts of two occurring with equal and greatest frequency; ♀, do. 2.37–2.52, average 2.44, cells surmounted four + parts of two to six + part of one, greatest frequency = five + two. Stigma, costal margin, hind wings: ♂, 2.37–2.89, average 2.62, cells surmounted three + two to six + one, no greatest frequency; ♀, do. 2.66–2.81, average 2.71, cells surmounted four + two to five + two, no greatest frequency. Postnodal cross-veins, front wings: ♂, 25–32, average 28.35; ♀, 26–30, average 27.7. Do., hind wings: ♂, 22–29, average 26.2; ♀, 22–27, average 24.7.

Habits. Mr. Williamson noted of the male at Cisneros: "Hung on vine in shade like an *Archilestes grandis*—wings expanded but not horizontal. Only one seen." Cisneros, at an elevation of 1060 meters, and Cristalina, about 320 meters, have been described by Mr. Williamson.[31]

Philogenia silvarum (Text-figs. 14, 15, page 18 (prothorax ♀); Plate II, fig. 38 (apps. ♀); Pl. IV, figs. 61–63, 65 (apps. ♂); Pl. V, fig. 80 (prothorax, ♂).

Philogenia silvarum Ris, Archiv f. Naturges. 82 jahrg. abt. A, 9 heft, pp. 78, 80, fig. 36 (apps. ♂), 1918, (Peru: 1 ♂, 2 ♀ Pozuzo).

Material examined: PERU: Campamiento Colonia del Perené, June 4, 1 ♂, 1 ♀, June 5, 3 ♀, June 6, 1 ♀, June 10, 1 ♂ 2 ♀, June 14, 6 ♂ 13 ♀, June 18, 2 ♂ 2 ♀, June 19, 1 ♂ 2 ♀, June 20, 1 ♂ 1 ♀, June 21, 1 ♂, June 24, 1 ♀, June 27, 1 ♀, a number of these also labeled Quebrada Represa. Total, 13 ♂, 27 ♀. The last two specimens collected by Dr. W. T. M. Forbes, all the others by Mr. Jesse H. Williamson; all in the collection of Mr. E. B. Williamson of Bluffton, Indiana.

Colonia del Perené is on the Rio Perené, Department of Junin, elevation 2230 feet.[32]

As the present material is more extensive than that available to Dr. Ris, it is herewith described.

♂. Dorsal surface of head blackish brown to paler brown, individuals with pruinosity on the body not invariably with the darkest brown on the head; the yellowish brown stripe from each lateral ocellus to the eye of the same side, behind the antenna, bounded posteriorly, in some at least, by a black line and behind this latter can, in some, be distinguished a triangular spot of yellowish brown adjoining each eye. Antennae blackish

[31] A Collecting Trip to Colombia, South America, University of Michigan Museum of Zoology, Miscell. Publ. no. 3, pp. 16–18. Feb., 1918. Also in Occasional Papers of the same Museum, no. 130, pp. 28 and 29, Feb., 1923.

[32] Williamson, Occas. Papers, Mus. Zool. Univ. Mich., no. 130, p. 28, (1923).

brown but much of the first two joints pale. Labium, stipites and ventral surface of mandibles brownish yellow, an oval spot of darker brown on the center of the median labial lobe.

Pronotum yellowish brown or darker, with four darker or even blackish brown spots, one on each of the two convexities of the middle lobe, one on the middle of the fore lobe and one on the middle of the hind lobe, these four tending to coalesce in presumably older individuals. Mesepisterna brown with darker streaks of varying width so that it is difficult to determine which are due to *post mortem* changes. The following black in addition to those mentioned on page 6: proepimera, a stripe, continuous with the black of the mesinfraepisternum, for the whole length of th mesepimeron, metinfraepisternum and a stripe continuous with it along the second lateral suture (metapleural of Garman) but chiefly on the metepisternum, a stripe on the metepimeron tending to be confluent with the preceding black at the antero-ventral end of the sclerite. The remaining parts of the sides of the thorax are much paler than the mesepisternal brown and are perhaps pale bluish, bluish brown, or yellowish in life; they form stripes at or close to the antero-superior margins of mesepimeron, metepisternum and metepimeron and the ventral margin of the last named; that on the metepisternum is the most vivid of these.

Abdomen: a pale yellowish, or pale greenish, longitudinal stripe on each side of one and two for almost the entire length of each segment, on three for never more than one-seventh of its length.

Pruinosity is present to a variable extent in different individuals on the thoracic pleura, the ventral surface of the thorax, the wing-bases, coxae, the sides of abdominal segment two, the dorsum of nine, ten and eleven and the ventral surface of four to eight near their anterior ends.

Superior abdominal appendages, .89–.96 mm. long, but little longer than segment ten (.6–.7 mm., which latter is bifid for its posterior half, margins of the incision rounded), in dorsal view: converging, narrowing from base to apex, especially on the outer (lateral) side in the terminal two-fifths of their length, no, or but little, enlargement (in this view) of the mesal margin, apex rounded, obtuse. Viewed from within and above (dorso-mesal view) the mesal surface is seen to extend vertically ventrad and then to be produced cephalad as a process whose extremity often lies mesad of the latero-superior margin of the inferior appendage of the same side. In profile view: the dorsal margin slopes gently caudad and ventrad to the apex, which in some is slightly upturned, the ventro-lateral margin slopes gently caudad and dorsad to about three-fifths of the appendage length, where

it presents a convex tubercle beyond which it describes a slight concave curve obliquely dorsad to the apex, which is much more acute than in dorsal view; the ventro-mesal process visible as a straight edge extending from the proximal side of the tubercle just mentioned ventrad to the ventro-lateral margin, to the base of the inferior appendage, in most specimens; its apex also visible when the superior appendage is raised as in our figure 62.

The eleventh abdominal segment is very noticeable in examining the superior appendages since it is produced dorsad into two parallel, longitudinal, approximated folds which in dorsal view give the appearance of a bifid process immediately behind segment ten and between the bases of the right and left superior appendages. This segment is not described or figured by Dr. Ris.

Inferior appendages, 1.26–1.18 mm. long, extending farther cephalad, but not farther caudad, than the superiors, black as they also are; in profile view nearly three-fourths (.9–.74 mm.) as high at base as long, dorsal margin at base with a large convexity which conceals the cephalic apex of the ventro-mesal process of the superior appendage of the same side; at the distal margin of this convexity (or at a little more than one-half the total length of the appendage), the appendage is abruptly contracted into a slender, almost straight process, which is much more nearly at the level of the ventral than of the dorsal margin and which tapers gradually to an acute apex. In ventral view: proximal half having a maximum width of about .6 mm., the dorsal post-basal convexity projecting from the distal margin of this half, distal half of the appendage forming a slender almost straight process along the mesal margin and tapering gradually to an acute apex; the degree of divergence of the distal processes of the two inferior appendages increases with defaecation.

Wings uncolored or pale obscure brownish, usually slightly darker in either case at the extreme apex but the extent of this apical brown vague and ill-defined. Two males with well-developed pruinosity on the dorsum of nine, some on ten but hardly any on other parts of the body, with brown of the dorsal surface of the head pale, have the wings uncolored, even at the extreme apex.

The physiological significance of the pruinosity of this species is puzzling, as the appearance of this condition is generally considered to be an accompaniment of increasing age and has been correlated with maturation of the gonads by Tillyard (Biology of Dragonflies, 1917, p. 246). Some males of *silvarum*, whose body generally, in colors and softness of chitin, appears to be immature, have the dorsum of abdominal segment nine strongly pruinose, while others, whose general features are evidently

older, have little pruinosity on this segment but more on the thorax.

♀. Differs from the male as follows:

Most of the labrum and of the external surface of the mandibles clouded with blackish brown leaving the margins pale green or yellow; brown on the labrum broken into two spots in one female; teneral females have no brown on labrum or mandibles and the clouding appears on the labrum before it is visible on the mandibles.

Pale yellow, lateral, longitudinal stripe on abdominal segment three may extend for almost the entire length of the segment. A similar stripe may be present on segments four to seven for one-fourth of the length of each. A pale green spot on each side of the dorsum of segment nine, or of eight to ten; those of the same segment may be confluent and on nine may occupy the whole dorsum.

Appendages, .44–.6 mm. long, subequal in length to ten, conical, black. Segment ten excised at the middle of its hind dorsal margin for one-fourth to one-seventh of its length. Segment eleven, in dorsal view, forming a horizontal, triangular, or subsemicircular plate, its extreme apex slightly bifid.

Wings uncolored or pale brown, extreme apices brownish.

Pruinosity apparent on wing bases, ventral surface and sides of the thorax including the prothorax.

Each lateral extremity of the hind lobe of the pronotum produced into an acute-angled process, which does not exist in the male.

The black stripe on the mesepimeron has in some a bronzy green reflection.

♂, ♀. *Dimensions, etc.* Ten males and ten females give the following figures:

Abdomen: ♂, 35.5–43, average 39.4 mm.; ♀, 37.5–40, average 38.4 mm. Hind wing: ♂, 28–35, average 32.2 mm.; ♀, 32–35, average 33.8 mm. Stigma of front wing, costal edge: ♂, 2.07–2.59, average 2.37 mm., surmounting three cells + part of one other to five + one cells; ♀, 2.15–2.59, average 2.35 mm., surmounting three + one to five + two cells, most frequently four + one. Stigma of hind wing, costal edge: ♂, 2.44–2.74, average 2.6 mm., surmounting three to four + two cells; ♀, 2.44–2.81, average 2.6 mm., surmounting three + one to four + two cells, most frequently four + one. Postnodal cross-veins, front wings: ♂, 20–27, average 24.4; ♀, 22–27, average 24.25. Postnodals, hind wings: ♂, 19–24, average 21.9; ♀, 19–23, average 21.15.

Philogenia augusti new species (Text-fig. 20, page 18 (prothorax ♀); Plate IV, figs. 66–69 (apps. ♂); Pl. V, fig. 81 (prothorax ♂).)

Material examined: PANAMA, Porto Bello, 2 ♂, Feb. 27, 1911; 2 ♂, April 17, 1912; 2 ♂, 1 ♀, April 18, 1912. August Busck, collector. Total, 6 ♂, 1 ♀, U. S. National Museum.

Type: one male, Porto Bello, Panama, Apr. 18, 1912, figured on Plate IV, figs. 66–69.

♂. Blackish, with some dull metallic green reflections on head and thorax; anteclypeus and inferior edge of the postclypeus pale yellow, green or blue, in some; mentum and stipites pale dull yellowish, much of the first two antennal joints pale.

Most of the dorsal surface of the fore prothoracic lobe, an ill-defined area on each side of the dorsum of the mid-prothoracic lobe and three-fifths of each mesepisternum reddish brown, the last-named leaving a mid-dorsal black stripe, with metallic green reflections, whose width at the antealar sinus is 1.3–2.5 mm. and steadily diminishes to .5–1.0 mm. near or at the anterior end of the mesothorax, where its width more or less exactly corresponds to that embraced by the fork of the carina. Pale yellowish stripes on the (obsolete) first and second lateral thoracic sutures and along the latero-ventral metepimeral carina. Sides and ventral surface of thorax and the coxae pruinose here and there.

Abdominal segment one with dorsum at base, the intersegmental articulation between one and two, two with a spot on each side, dull yellowish. Varying areas of pruinosity on the dorsum of the hind end of eight, on dorsum of nine and of ten, and still smaller patches on one and two, in different individuals.

Legs pale (bluish ? in life), femora darker, tibiae inferiorly and tarsi in whole or in part blackish, trochanters pale yellow.

Superior abdominal appendages in dorsal view subequal in length to the tenth segment, directed caudad, the outer (lateral) margin straight or slightly convex for the first three-fourths of the length of the appendage, concave in the remaining fourth, inner (mesal) margin concave for about four-fifths of the length, thence directed laterad and caudad so that the last fifth of the appendage is truncated obliquely.

Inferior appendages in dorsal view slightly longer than the superiors, widely divergent from each other in the distal two-thirds and tapering to their apices, which are wider apart than are the apices of the superiors.

Superior appendages in profile view: dorsal margin curved ventrad from a point shortly beyond the base, more strongly in the distal half; the lateral margin (of the dorsal view) now presents two concave curves; the proximal curve is the longer, beginning a little beyond the base, and separated from the distal curve by a short but strong convexity, located at a distance from

the base of the appendage equal to two-thirds to four-fifths of the length of the appendage; inner or mesal margin (of the dorsal view) produced ventrad as a lamella which forms the slightly concave, horizontal, ventral margin of the appendage in the distal two-thirds of its length, in profile view; apex of the appendage rounded.

Inferior appendages in profile view: highest at the base, superior margin descending in a shallow concave curve to a conical tooth at about three-fourths' length, beyond which the appendage is strongly contracted and tapers gradually to the rounded apex; inferior margin presenting two slightly convex curves, the proximal and stronger stopping at one-third length, where the distal begins and continues to the apex.

Inferior appendages in ventral view: combined width at extreme base 1.3–1.5 mm., thence narrowing to 1.1–1.3 mm. at one-fifth or one-fourth length, thence steadily increasing to a distance of 1.7–2.2 mm. at their apices; the mesal margins of the two appendages are subparallel for the proximal half to one-third of their length, beyond which they strongly diverge from each other.

On viewing a superior appendage obliquely from above and within, the inferior part of the proximal edge of the ventral lamellate process of the mesal margin can be seen to form almost a right angle with the ventral edge and to ascend to a well marked process, dorsal to which the proximal edge ascends at an oblique angle caudad and dorsad to join the body of the appendage. From the same point of view one sees that the superior margin of each inferior appendage is prolonged dorsad as an erect, slender process reaching above (*i. e.*, dorsal to) the level of the ventral edge of the lamella of the superior appendage and almost applied against the hind surface of abdominal segment ten. These two erect slender processes are shown in fig. 67, Pl. IV.

Hind margin of the prothorax regularly convex throughout, or flattened on the middle and each side thereof as shown in fig. 81, plate V.

Wings hyaline or slightly smoky, tips clear or edged with brown for a width of .7 mm. from the distal end of the stigma, this brown concave within. Stigma dark reddish brown with black enclosing veins.

♀. Differs from the ♂ as follows: mid-dorsal thoracic black stripe much narrower, hardly wider than the carina although a metallic green reflection extends farther laterad on each side of

the carina, anterior fork of the carina not filled with black. A quadrate pale (blue ?) spot occupying the anterior three-fifths of the dorsal surface of abdominal segment nine, the inter-segmental membranes of seven to eight and eight to nine perhaps of the same color. No pruinosity on the abdomen except for a small patch on each side of one at base. Abdominal appendages subequal in length to ten, conical, terminating in two to three spinules. Palps of the genital valves .67 mm. long, projecting beyond the level of the apices of the abdominal appendages, the apex of the ovipositor at almost the same level as the apices of the appendages. Hind margin of the prothorax bisinuate with each lateral angle of about seventy-five degrees.

♂, ♀. *Dimensions, etc.* The six males and one female give the following figures, except that the abdomens of only four males are included, the other two having these segments partly telescoped in mounting.

Abdomen: ♂, 43.5–47, average 44.9 mm.; ♀, 40.5 mm. Hind wing: ♂, 32–39, average 36.2 mm.; ♀, 37 mm. Stigma, front wing, costal edge: ♂, 2.4–3, average 2.68 mm., surmounting four cells + parts of two others to seven + one cells; ♀, 2.8 mm. surmounting six + one (right), seven + one (left) cells. Stigma, hind wing, costal edge: ♂, 2.6–3.2, average 2.87 mm., surmounting four + two to seven cells; ♀, 2.9 mm. surmounting five + one (r), six (l) cells. No one of the surmounted cells markedly larger than any of the near-by cells except in the left hind wing of one male. Postnodals, front wings: ♂, 27–33, average 29.25; ♀, 25, 26. Postnodals, hind wings: ♂, 23–28, average 25.5; ♀, 22, 23.

The specific name proposed is in honor of the collector.

Philogenia championi (Plate III, figs. 55–57 (apps. ♂).)

Philogenia cassandra Higgins, Proc. Acad. Nat. Sci. Phila. 1901, p. 136, (Chiriqui).

Philogenia championi Calvert, Biol. Centr.-Amer., Neur., p. 61, pl. v, figs. 3, 4, 4*a* (apps. ♂), 1901, (Panama, Volcan de Chiriqui below 4000 ft., 1 ♂).

Material examined: PANAMA, Chiriqui Mts., Boquete, elevation 4000 ft., March 24, 1923, 3 ♂. F. M. Gaige, collector. University of Michigan, Museum of Zoology, Ann Arbor, Michigan.

The present material shows the following differences when compared with the description and figures of the unique type, now in the British Museum (Natural History), London:

Frons not pale inferiorly, anterior (or inferior) margin of the nasus pale (yellow or blue ?), the two pale spots of the nasus confluent in two specimens, vertex brownish, agreeing with

the generic description given *anteà*, page 5, mentum chiefly yellow. Abdominal segments three and four with a pale mid-dorsal line, a lateral, longitudinal, narrow, pale yellow stripe on the anterior part of three to seven, on whole length of two, dorsum of ten, nine and the posterior part of eight pruinose. The meso-ventral margin of the superior appendages, instead of forming a process when seen in profile, as do many other species of this genus, presents an even, continuous, slightly convex outline as shown in fig. 56, plate IV; at its proximal end it forms an angulate process, directed proximad, lying within a concavity of the mesal face of the appendage (fig. 56*a*).

The ventral view of the inferior appendages (not shown in the figures accompanying the original description) is almost exactly as in our present figure 73, plate V, for *Ph. carrillica*.

Hind margin of the hind lobe of the pronotum generally convex, a little flattened on the middle and on each side, with no angulate lateral projections.

Stigma of the front wings: 2.15–2.74 mm. long (costal edge), surmounting four cells + parts of two others to six + one cells, five + one most frequently (three out of six wings). Stigma of hind wings: 2.52–2.96 mm., surmounting four + one to five cells, four + one most frequently (three out of six wings). Postnodals: front wings, 26–29; hind wings, 23–25 (25 in three out of six hind wings). Abdomen: 41–46 mm.; hind wing, 33–39.5 mm.

Philogenia carrillica (Text-figs. 3, page 10 (penis), 9 and 10, page 18 (prothorax ♀); Plate V, figs. 70–73, 77, 78 (apps. ♂).)

Philogenia carrillica Calvert, Biol. Centr.-Amer., Neur., p. 356, pl. VII, figs. 6, 7, 12 (apps. ♂), 1907, (Costa Rica: Carrillo 2 ♂, 2 ♀, Juan Viñas, 1 ♂).

Calvert, A. S. & P. P., A Year of Costa Rican Nat. Hist., pp. 193, 238, 316–318 (habits, bodily proportions, eye-size; Costa Rica: Juan Viñas, Rio Banana), 1917.

Ris, Archiv Naturges. 82 jahrg., abt. A, 9 heft, p. 81, 1918, (Costa Rica: 1 ♂ Infernillo,[33] Reventazon, 1000 m., 1913; 1 ♂, 1 ♀, Orosi, Irazu, 1500 m., 1913).

Material examined (all from Costa Rica): Banana River, forest near upper reservoir for Limon, altitude less than 30 meters (100 feet), November 9, 1909, 1 ♂. Peralta, Chiriqui (?) river trail, ca. 360 m. (1200 ft.), August 10, 1909,

[33] Infernillo is the older name of the locality Juan Viñas.

1 ♂. Juan Viñas, near the Rio Reventazón, 760–790 m. (2500–2600 ft.), October 4, 1909, 1 ♂; April 28, 1910, 1 ♂; May 1, 1910, 1 ♂. Juan Viñas, at the waterfalls near the railroad tracks, 1030 m. (3400 ft.), June 24, 1909, 1 ♂; June 27, 1909, 1 ♂; July 22, 1909, 2 ♂; December 2, 1909, 1 ♂; April 26, 1910, 2 ♂ found transforming ("nearer waterfall"). Carrillo, 300 m. (984 feet), 1 ♂, the "badly-flattened," 1 ♀, taken by C. F. Underwood, paratypes from the collection of F. D. Godman. Costa Rica, 1 ♂ taken by C. H. Lankester. All the preceding in the writer's collection. La Suiza de Turrialba, 2 ♂, Sept. 22 and Oct. 29, 1921, collected by Pablo Schild, now in the collection of Mr. Hugo Kahl, of Pittsburgh, Pennsylvania. Total: 16 ♂, 1 ♀.

I made two descriptions of the colors of this species from specimens taken near the Banana River, November 9, 1909, and at the foot of the nearer waterfall, Juan Viñas, December 2, 1909. These notes were made *immediately after death*. I combine them here into a single description, mentioning the differences where such exist.

♂. Labrum, external surface of the mandibles and adjacent part of genae pale yellow (Banana River) or pale green (Juan Viñas).[34] Eyes dark brown above, becoming olive below (Banana River) or behind inferiorly pale green over a small area with a single, blackish pseudopupilla therein (Juan Viñas). Dorsal surface of head black with a little metallic green reflection; an indistinct, obscure, pale brownish streak from each lateral ocellus to the adjacent eye running back of the antenna (Juan Viñas).

A circular reddish brown spot on each side of the middle prothoracic lobe (Juan Viñas). Thoracic dorsum brown, a mid-dorsal black stripe widening superiorly but leaving a brown line along each side of the lower two-thirds of the black mid-dorsal carina (Banana River), a reddish-brown ante-humeral stripe occupying about three-fifths of the mesepisternum immediately in front of the humeral suture (Juan Viñas). Sides of thorax black, a yellow (Banana River), or pale obscure brownish yellow (Juan Viñas), stripe on first and on second lateral suture and along latero-ventral metathoracic carina, entire pectus yellow.

Abdomen black, base and hind margin of segment one dorsally, (two or three points on each side of two—this noted for Banana River only), a mid-dorsally interrupted, basal, transverse ring on three to seven (prolonged a short distance backward, *i. e.*,

[34] Pale blue in a male from Juan Viñas taken October 4, 1909, on which I have a few incomplete notes of the living colors.

caudad, as a line, on each side of three to five, Juan Viñas) dull yellowish; hind end of dorsum of eight, all of dorsum of nine and of ten pruinose white.

Legs pale yellowish, knees and tarsal articulations blackish (Banana River); or, legs gray, tibiae inferiorly and tarsi black (Juan Viñas).

The following notes result from a comparison (in 1923) of the dried specimens with the preceding descriptions of the living colors.

♂. Free (anterior or inferior) margin of the labrum narrowly edged with black. Apex of the mandibles, median and lateral lobes of the labium (but not the mentum) black. Rhinarium (anteclypeus), which is very small, and inferior edge of the nasus (postclypeus) of the same color as the labrum, pale yellow or pale green. First two joints of the antennae largely pale yellowish, especially anteriorly. Nasus with a pair of yellow dots in the Juan Viñas male of July 22.

The two preceding descriptions of the thoracic dorsum in the Banana River and Juan Viñas males are mutually complementary.

Width of one-half of the mid-dorsal thoracic black stripe (which has a dull metallic green reflection), at mid-height of the mesepisternum on which it lies, .4–.6 mm.; this stripe widens superiorly and its lateral margin is often difficult to distinguish, apparently reaching laterad in some to the humeral suture at its upper end, in others not so far. The "brown line along each side of the lower two-thirds of the black mid-dorsal carina" is of nearly the same width as the black on the carina, where visible; in some it has disappeared, perhaps by encroachment of the black.

Abdomen: on each side of segment two are two or three pale yellow spots (Juan Viñas, Dec. 2) or all or some of these are united into a longitudinal stripe. The lateral yellowish line is visible on each side of segment three for two-fifths of the segment's length in the Banana River example and on three to five or six in many of the others. The pruinosity on the last three segments has entirely disappeared from the Banana River specimen and the Juan Viñas example of July 22, although it is very distinct here and there on the pectus and sides of the thorax. It is present on abdominal segments eight to ten and on thorax in many, but not all, of our males.

First tibiae blackish inferiorly in the Banana River and Peralta examples, blackish or dark brown inferiorly on all three tibiae in the Juan Viñas specimens.

The prothorax, as seen in antero-dorsal view, is not very different from that of the female of *expansa*, fig. 16, page 18.

The two males taken while transforming at Juan Viñas, April 26, 1910, have the black edging on the labrum much wider than in the other males. If this be not a *post mortem* change, these immature males would thus approach the females in this feature, also in having a lateral yellow line on each side of seven as well as on three to six and the dorsum of nine and part of that of ten, pale (blue ?). The paratype from Carrillo also has the dorsum of nine pale (blue ?), as was noted in the original description; the remainder of the body is much faded.

Among the sixteen males of *carrillica* which are before me two slightly different forms of the superior appendages are evident. In one of these forms, represented by the two males from La Suiza de Turrialba and by one male from Juan Viñas (June 27, 1909), the apex of each superior appendage is more bluntly truncated, the lateral margin of the distal fourth is straighter, less concave, seen in dorsal view (Plate V, fig. 70). The other form is that of the remaining thirteen males and is shown in fig. 71 of the same plate. Profile views show no *constant* difference correlated with that of the dorsal views, nor are there differences in the general dimensions or number of postnodals accompanying the two forms. As far as present evidence goes, they can not be regarded as of taxonomic importance.

♀. Five females from the Atlantic slope of Costa Rica are before me: Banana River, 1 ♀; Rio Azul, east of Turrialba, 1 ♀; Carrillo, 1 ♀; Cachí, 2 ♀. By the structure of the prothorax they may be separated into three forms represented by: 1. the two females from Banana River and Rio Azul; 2. the single female from Carrillo; 3. the two females from Cachí. From the same area only one species represented by males has thus far been found—that above described as *Philogenia carrillica*. It is, therefore, necessary to determine which of these three forms of females is *carrillica*. It will be noted that the localities from which the females come do not afford any decisive evidence on this point, since the males collected both from Banana River and from Carrillo are of the same form, *i. e.*, *carrillica*, while from Cachí no males are at hand.

The possibilities are: (*a*) That one of these three forms of females is the true *carrillica* and that the other two are of different species whose males are as yet undiscovered.

(*b*) That all three forms of females belong to *carrillica* and that the female individuals of this species are consequently polymorphic.

As none of these females have been taken mating or reared from eggs of known parentage and the other evidence is equally weak for either (*a*) or (*b*), I assume, provisionally, that the female from Carrillo, originally described as of *carrillica*, is that species and that the other two forms are specifically different from *carrillica* and from each other, giving them specific names by which they may be distinguished.

♂, ♀. *Dimensions, etc.* Ten males, all of them having the superior appendages with the more slender apex, and the single female from Carrillo give the following figures:

Abdomen: ♂, 40.5–47, average 44.3 mm.; ♀, 34.5 mm. Hind wing: ♂, 34–40, average 36.9 mm.; ♀, 31 mm. Stigma of front wings, costal edge: ♂, 2.29–2.74 mm., average 2.59 mm., surmounting four cells + part of one other to seven + one cells, most frequently five + one; ♀, 2.15 mm., surmounting three + two (right) or four + one (left) cells. Stigma of hind wings, costal edge: ♂, 2.37–3.03 mm., average 2.77 mm., surmounting four + two cells to seven cells, most frequently five + one cells; ♀, 2.37 mm., surmounting three + two cells. Postnodals, front wings: ♂, 24–31, average 27.8; ♀, 24 (right), 23 (left). Postnodals, hind wings: ♂, 23–28, average 25.2; ♀, 21 (r), 19 (l).

Habits and Habitats. The Banana River male was taken in a damp, dark forest of tall trees and low palms, the latter two to four feet high. It was associated with *Protoneura remissa* with which it shared these traits: that they seemed to travel only short distances—a few yards—and to float through the air instead of moving rapidly; and both have a pale (pruinose) spot near the hind end of the abdomen, nearly all the remainder of the body being dark, so that often all one can see of them in the gloom is the pale spot. I am tempted to think that the pale spot is a means of recognition among individuals of the same species.

The male taken at Juan Viñas, October 4, 1909, was at a spring on the side of a zigzag road which descended from the railroad to the level of the Rio Reventazón. The spring was surrounded by vegetation so as to be well shaded and fairly dark. Of this male was noted that it "held its wings expanded when at rest.

Difficult to see in the shade where it was—only the pruinosity on dorsum of 10, 9 and hind part of 8 conspicuous. Pectus slightly pruinose but this not visible." Farther down this road, at a stream crossing the last zigzag, the male of April 28, 1910, was taken. The road proceeded nearly on a level with the bed of the river for a kilometer or so and then crossed the river by a bridge. A brook in woods near this bridge furnished the male of *carrillica* of May 1, 1910, associated with *Cora chirripa*, *Argia medullaris* and a species of *Palaemnema* found transforming.

Most of the individuals of *carrillica* taken at Juan Viñas were near the foot of a water fall where *Thaumatoneura inopinata* was often observed. The water usually disappeared under rocks a short distance below the actual foot of the fall. The *carrillica* male of June 24, 1909, was found "in a shady place, where many long vines and lianas hung over the dry bed of the same stream, resting on one of the lianas." That of June 27 was taken in the same place and those of July 22 and December 2, 1909, and April 26, 1910, nearby; that of December 2 is recorded as "resting on a twig in bright light, although not sunshine," and in connection with those of July 22, "Philogenia holds its wings horizontal at rest."

Philogenia expansa new species (Text-figs. 16, 17, page 18 (prothorax ♀).)

Material examined: COSTA RICA, Banana River, forest near upper reservoir for Limón, altitude less than 30 meters (100 feet), November 9, 1909, 1 ♀. Rio Azul, east of Turrialba, alt. ca. 600 meters (1960 feet), in woods, July 27, 1909, 1 ♀. Both collected by Philip P. Calvert and to be placed in the collection of the Academy of the Natural Sciences of Philadelphia. Total: 2 ♀.

Type, the Rio Azul female.

♀. These two females have been referred to under *Ph. carrillica*, *anteà*, page 48. These notes were made on the Rio Banana female:

Living colors differ from those of the male [of *carrillica* taken at the same place and date] as follows: Labrum chiefly black, yellow only at base. Pale thoracic and abdominal markings more bluish, those on side of abdominal segment two consisting of a basal dot followed by a narrow stripe. Anterior dorsal two-thirds of abdominal segment nine with a quadrate blue spot, articular membrane of eight to nine somewhat similarly colored.

The following data are based on the dried specimens:

The Rio Azul female has the labrum blue, narrowly edged with black. Mandibles in both females yellow, with no dark central spot. The mid-dorsal thoracic black stripe, with dull green reflections, completely divided lengthwise into three stripes, one on each mesepisternum, separated from the mid-dorsal carina by pale reddish brown (which is as wide as the black on the carina), and tapering acutely to its anterior end which is at about one-half the length of the mesepisternum in the Rio Banana example, or at one-third the length of this sclerite from the anterior end thereof in that from Rio Azul. The latter also has pale dorsal markings on abdominal segment nine.

The structural features which distinguish *expansa* are given in the key to females, *anteà*, page 17.

Dimensions, etc., (those of the Rio Azul specimen in each case first). Abdomen; 40, 39 mm.; hind wing: 37, 36 mm.; stigma, front wings, costal edge: 2.66, 2.37 mm., surmounting four cells + parts of two others (right), six + one (left), six + one (r), five (l); stigma, hind wings, costal edge: 2.89, 2.44 mm., surmounting six (r), five + one (l), four + two (r), si (l) cells; postnodals, front wings: 24 (r), 26 (l), 26 (r), 28 (l); hind wings: 22 (r), 21 (l), 23 (r), 24 (l).

The specific name proposed refers to the condition of the proepimeron.

Philogenia lankesteri new species (Text-figs. 18, 19, page 18 (prothorax ♀).)

Material examined: Costa Rica, Cachí, altitude ca. 1100 meters (3600 feet) October 2 and 3, 1909, 2 ♀ taken by Messrs. W. Schaus and J. Barnes and given by them to the writer.

Type, the ♀ of Oct. 2, to be placed in the collection of the Academy of Natural Sciences of Philadelphia.

♀. These two females also have been referred to under *Ph. carrillica*, *anteà*, page 48. They have the labrum greenish or bluish yellow narrowly edged with black (Oct. 2), or brown, narrowly bluish at base (Oct. 3); mandibles yellow with no dark central spot; abdominal segments eight and nine without dorsal pale markings, two to seven with the lateral, longitudinal, bluish green stripes.

The structural differences in the prothorax by which they are chiefly to be distinguished are given in the key to females, *anteà*, page 17.

Dimensions, etc., (those of the Oct. 2 female first in each case). Abdomen: 39, 40.5 mm.; hind wing: 38, 37 mm.; stigma, front wing, costal edge: 2.66, 2.74 mm., surmounting three cells + parts of two others (right), three + one (left), three + two (r, l);

stigma, hind wing, costal edge: 2.81, 2.81 mm., surmounting four + two (r), three + one (l), three + two (r, l); postnodals, front wings: 24 (r, l), 21 (r), 20 (l); hind wings: 22 (r), 20 (l), 20 (r), 17 (l).

The specific name is in honor of Mr. C. H. Lankester, a resident of Cachí at the time when these two females were taken and the host of Messrs. Schaus and Barnes and of the present writer on various occasions, to whose active interest in all matters of natural history it is a pleasure and a duty to testify.

The unassociated males of *Philogenia* which one would first seek to associate specifically with these females are those of *Ph. championi* from the southern slopes of the Volcan de Chiriqui, Panama (*anteà*, page 44). The distance between this locality and Cachí in a straight line is about 160 kilometers (100 miles) with a cordillera, rising to 3000 meters (9800 feet) and more, between. The dimensions of *championi* males, the only features comparable to those of the females, agree just as well with those of the females referred to *carrillica* and *expansa* as with those of *lankesteri*. The best course, therefore, seems to be to designate these structurally different, unassociated females by distinct names until males associated with them are found.

Philogenia terraba (Text-figs. 1, page 4 (venation), 12 and 13, page 18 (prothorax ♀); Plate V, figs. 74–76, 79 (apps. ♂).)

Philogenia terraba Calvert, Biol. Cent.-Amer., Neur., p. 356, tab. v, figs. 8, 9 (apps. ♂), 1907.

Material examined: COSTA RICA: Pacuare del Sur, southern Costa Rica, 600 m. (1970 feet), January 19, 1897, 1 ♂, the *type*, collected by H. Pittier, formerly in the collection of Prof. Charles C. Adams, presented by the latter to the Academy of Natural Sciences of Philadelphia. "Surubres pres San Mateo 250 m.," March, 1907, 1 ♀, P. Biolley, Acad. Nat. Sci. Phila. Bonnefil farm, Rio Surubres, 210 m. (700 ft.), October 17, 18 and 20, 1909, 2 ♂, 1 ♀, P. P. Calvert. Total: 3 ♂, 2 ♀.

The following is a description of the colors, made immediately after death, of a male and a female taken on the Bonnefil Farm, Rio Surubres, Costa Rica, October 17 and 18, 1909, respectively.

♂. Body generally blackish with dull greenish reflection, but the labrum and external surface of mandibles pale greenish yellow; eyes dark brown above, pale bluish olive below; ventral side of thorax and dorsal surface of hind edge of abdominal segment eight, of all of nine and of anterior part of ten pruinose.

♀. Eyes dark brown above, pale gray below with one black pseudopupilla. Body generally black with some dull metallic

greenish reflections. Most of the genae and of the external surface of the mandibles and a medially interrupted transverse basal streak on the labrum pale yellow. Rhinarium and lower edge of nasus luteous. Legs brown, blackish at the knees. Ventral side of thorax and of abdominal segments one to eight pruinose, more marked at the anterior end of each abdominal segment.

The following notes are the result of comparison of dried specimens with the preceding descriptions:

♂. Free margin of the labrum narrowly edged with black as in *Ph. carrillica* (Surubres males), or with reddish brown (type from Pacuare del Sur). Dorsal surface of head, apices of mandibles, lateral and median labial lobes black. Dorsum of thorax too much faded in all three examples to afford a description of coloring. Sides of thorax, pectus and abdomen in the type similar to those of *carrillica;* the two Surubres males have the abdomen blacker, the pale markings much reduced. Legs pale dull yellowish in the type, a little darker at the knees, more obscure in the Surubres males.

♀. Although my description of the living colors makes no mention of a pale (blue ?) area on the anterior two-thirds of the dorsum of nine, the dried specimen seems to possess such, as in the female of *carrillica.* In the teneral female from Surubres, March, 1907, doubtfully, and I now think correctly, referred to this species in the Biol. Cent.-Amer., Neur., p. 356, most of the labrum is lilaceous (except for the transverse basal yellowish streak), the thoracic dorsum is pale, unmarked, and the entire dorsum of nine is pale blue (?).

♂, ♀. The prothorax does not differ greatly in the two sexes; that of the female is shown in figs. 12 and 13, page 18.

Dimensions, etc. The 3 ♂, 2 ♀ give the following: Abdomen: ♂, 39–39.5; ♀, 38.5, 34.5 mm.; hind wing: ♂, 31.5–32.5; ♀, 33, 30 mm.; stigma, front wing, costal edge: ♂, 2.07–2.44 mm., surmounting four cells + parts of two others to five + two, four + two most frequently; ♀, 2.29 mm., surmounting three + two, to four + two cells; stigma, hind wing, costal edge: ♂, 2.44–2.52 mm., surmounting three + two to four + two cells, four + two most frequently; ♀, 2.37, 2.44 mm., surmounting three + two to five + one cells. Postnodals, front wing: ♂, ♀, 24–26; hind wing, ♂, 22–25, ♀, 21–22.

The female of *Ph. terraba* is apparently indistinguishable from that originally described as (and here considered to be) the female of *carrillica.* It has however been found in the same

localities as *terraba* males and no other females have been taken there. This indistinguishability of the assumed females of *terraba* and *carrillica* is parallel to that of the females of *cassandra* and *polyxena* (*anteà*, page 28). The males of *terraba* and *carrillica* differ more, in their abdominal appendages, from each other than the male of *cassandra* differs from the male of *polyxena*.

Habitat. The specimens collected in October, 1909, were taken in the gorge or ravine of the Rio Surubres, having steep sides and passing among many tall forest trees, as well as *Enterolobium* ("guanacaste"), palms, cacao, bull's horn thorn (*Acacia*), *Cecropia*, *Begonia* and *Selaginella*. Many small tributaries enter the river at this place—Bonnefil farm.

Explanation of Plates

Figs. 21, 22, 24–26, 28, 36, 37, 46, 47 were drawn by the late M. Menger; 50 and 51 by Mr. C. L. Withycombe; the others by P. P. Calvert, using a Zeiss compound microscope with compensating ocular 2, objective A with lower lens off and camera lucida. The magnification is about 15 diameters.

Plate I

Figs. 21–24. *Philogenia helena*, ♂, terminal abdominal appendages; 21, 22, 24, dorsal, right lateral and right ventral views, Bogotá, Brussels Museum; 23, right lateral view, right inferior appendage, Santa Fe de Bogotá, Lindig, Museum of Comparative Zoölogy.

Figs. 25–28. *Ph. cassandra*, ♂, terminal abdominal appendages; 25, 26, 28, dorsal, right lateral and right ventral views, San Esteban, Venezuela, Brussels Museum; 27, left superior appendage, dorso-mesal view, Venezuela, Schneider, Museum of Comparative Zoölogy.

Fig. 29. *Ph. schmidti*, ♂, northeast of Coroico, Bolivia, May 26, antero-dorsal view of middle (part) and hind prothoracic lobes.

Figs. 30, 31. *Ph. polyxena*, ♂, terminal abdominal appendages, right lateral and ventral views, Aroa, Venezuela, March 14, *type* ♂, Williamson collection.

Figs. 32–35. *Ph. schmidti*, ♂, terminal abdominal appendages, dorsal, right lateral, dorso-mesal of left superior appendage and ventral views of same individual as shown in fig. 29.

Plate II

Figs. 36, 37. *Philogenia margarita*, ♂, terminal abdominal appendages, dorsal and right lateral views, Teffe?, Brussels Museum.

Fig. 38. *Ph. silvarum*, ♀, apex of abdomen, dorsal view, Colonia del Perené, Peru, June 18.

Figs. 39–43. *Ph. elisabeta*, ♂; 39–40, terminal abdominal appendages, dorsal and right lateral views; 41, ventral view of inferior appendages; 42, dorso-mesal view of left superior appendage, *lbt*, latero-basal tubercle of left inferior appendage; 43, antero-dorsal view of hind lobe and part of middle lobe of prothorax; all five figures from the same specimen, Colonia del Perené, Peru, June 19, *type* ♂, Williamson collection.

Figs. 44, 45. *Ph. umbrosa*, ♂, terminal abdominal appendages, dorsal and right lateral views, Pozuzo, South Peru. After Ris, cited *anteà*, page 22, *type* ♂.

Plate III

Figs. 46–49. *Philogenia berenice*, ♂, terminal abdominal appendages; 46, 47, dorsal and right lateral views, Iquitos, Brussels Museum; 48, ventral view of inferior appendages; 49, dorso-mesal view of left superior appendage, Iquitos, Museum of Comparative Zoölogy, *type* ♂.

Figs. 50, 51. *Ph. raphaella*, ♂, terminal abdominal appendages, dorsal and left lateral views, Bogotá, McLachlan collection, London, *type* ♂.

Figs. 52–54. *Ph. cassandra*, ♂, antero-dorsal views of the hind lobe and all (54) or part (52, 53) of the middle lobe of the prothorax; 52 and 54, Bejuma, Venezuela, Feb. 14; 53, San Esteban, Venezuela, Feb. 9.

Figs. 55–57. *Ph. championi*, ♂, terminal abdominal appendages; 55 and 56, right dorsal and right lateral views and, 57, externo-oblique (dorso-lateral) view of left inferior appendage, Volcan de Chiriqui, Panama, *type* ♂, British Museum. After Biol. Cent.-Amer. Neur., cited *anteà*, page 44. 56*a*, dorso-mesal view, left superior appendage, Boquete, March 24, 1923.

Plate IV

Figs. 58–60, 64. *Philogenia cristalina*, ♂, terminal abdominal appendages, dorsal, right lateral, ventral (of the inferiors only) and dorso-mesal (of the left superior appendage) views, Cristalina, Colombia, Feb. 12, *type* ♂, Williamson collection.

Figs. 61–63, 65. *Ph. silvarum*, ♂, terminal abdominal appendages, dorsal, right lateral, ventral (of inferiors only) and dorso-mesal (of left superior appendage) views, Colonia del Perené, Peru, June 18, all from the same individual except the detail—a dorsal view of segment eleven only—placed a little below fig. 61, which is from a male taken June 4. The detail shown in the lowest part of fig. 63 is an outline of the apex of segment eleven viewed from behind and below; *x*, hind dorsal margin of segment ten.

Figs. 66–69. *Ph. augusti*, ♂, terminal abdominal appendages, dorso-mesal (of left superior appendage), dorsal, right lateral and ventral (of inferiors only) views, Porto Bello, Panama, April 18, 1912, *type* ♂, U. S. National Museum.

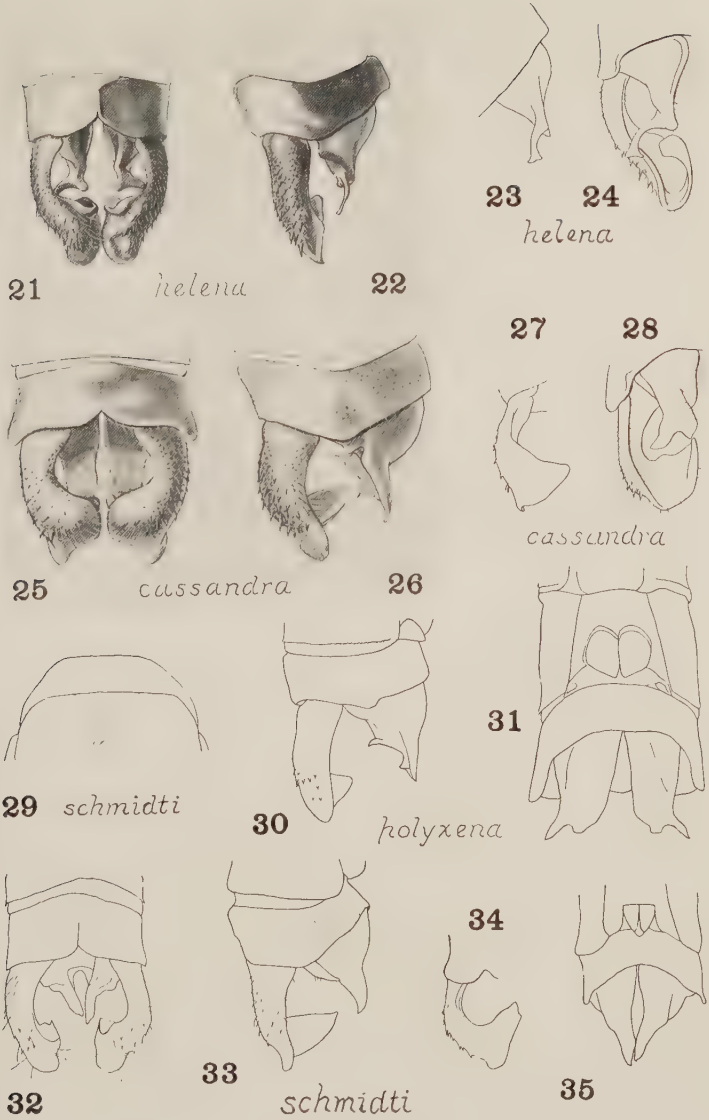
Plate V

Figs. 70–73, 77, 78. *Philogenia carrillica*, ♂, terminal abdominal appendages; 70, 78, dorsal and dorso-mesal (of left) views of superior appendages, La Suiza de Turrialba, Costa Rica, Oct. 29, 1921; 71–73, 77, dorsal, right lateral, ventral (of inferiors only) and dorso-mesal (of left superior appendage) views of appendages, Juan Viñas, Costa Rica, 2500 feet, May 1, 1910.

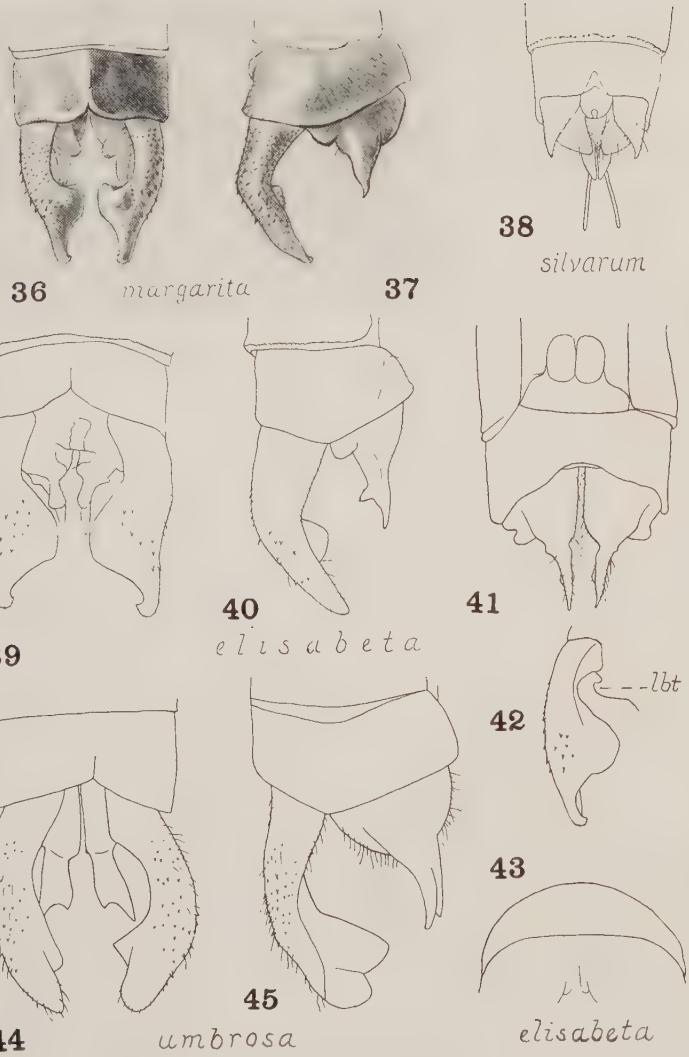
Figs. 74–76, 79. *Ph. terraba*, ♂, terminal abdominal appendages, dorsal, right lateral, dorso-mesal (of left superior appendage) and ventral (of inferiors only) views, Pacuare del Sur, Costa Rica, Jan. 19, 1897, *type* ♂, Acad. Nat. Sciences, Philadelphia.

Fig. 80. *Ph. silvarum*, ♂, antero-dorsal view of hind lobe and part of middle lobe of prothorax, Colonia de Perené, Peru, June 18.

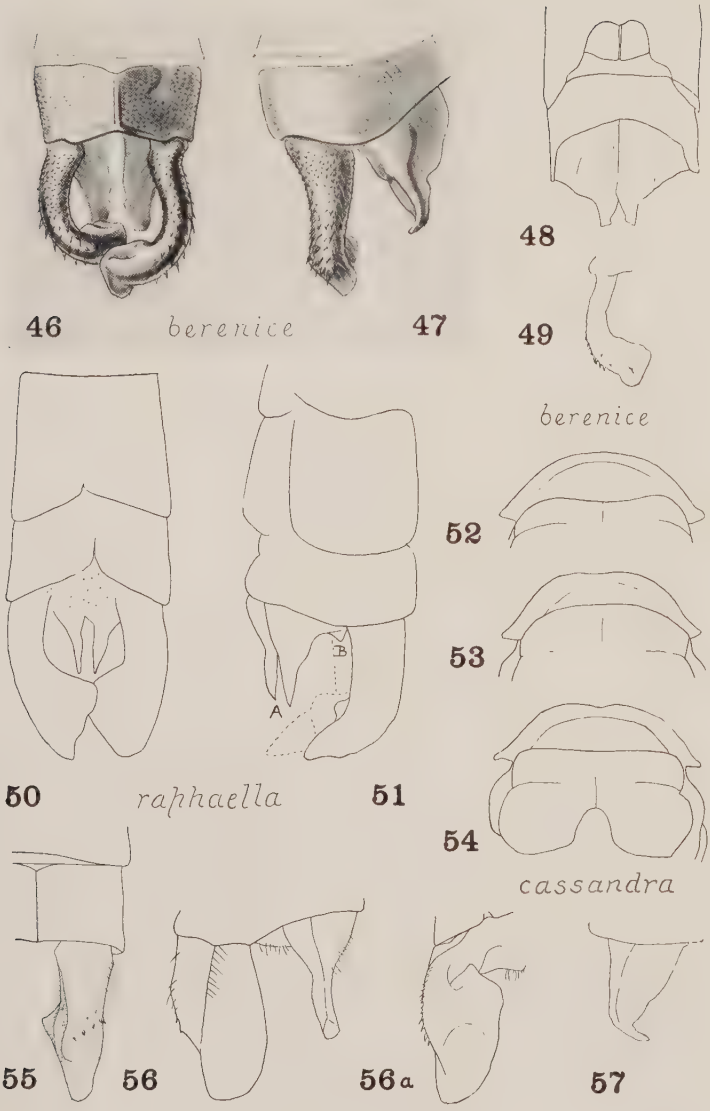
Fig. 81. *Ph. augusti*, ♂, the same, Porto Bello, Panama, April 18, 1912, *type* ♂, U. S. National Museum.

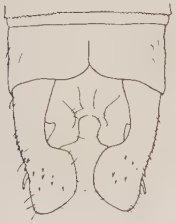


CALVERT—PHILOGENIA



CALVERT—PHILOGENIA

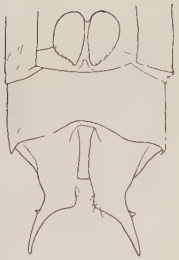

46
berenice
47
48
49
berenice
50
raphaella
51
B
A
52
53
54
cassandra
55
56
56a
57
championi



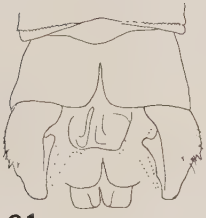
58

59

cristalina



60



61

62

silvarum

63

64

cristal-
ina

65

silvar-
um

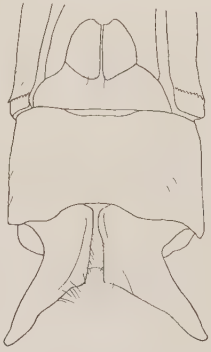
66

augusti

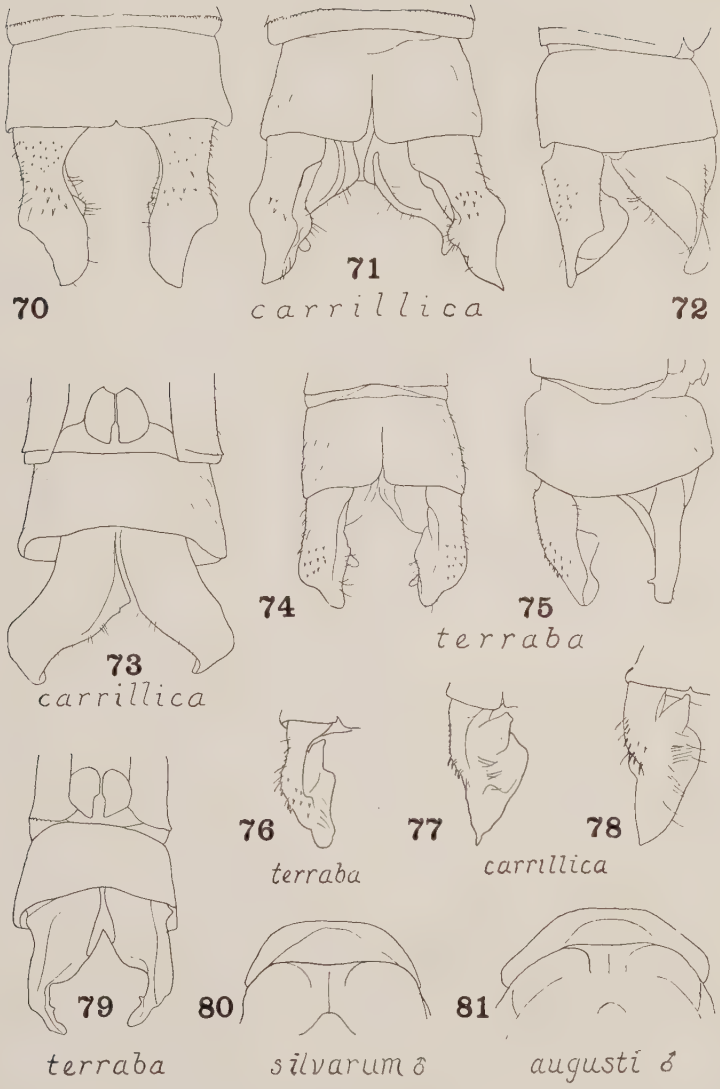
67

68

augusti



69



CALVERT—PHILOGENIA

ON THE MALE GENITALIA OF THE HESPERIIDAE OF NORTH AMERICA

PAPER IV

BY HENRY SKINNER AND R. C. WILLIAMS, JR.

This paper will treat of the genera *Poanes, Atrytone, Atrytonopsis* and their allies. The male genitalia of all the species are figured with the exception of *bulenta,* which is only known by the Boisduval and Le Conte figure, and *lunus* of which we lack material. The records given are of insects which we have observed and in the collection of the Academy of Natural Sciences of Philadelphia, and that of R. C. Williams, Jr.

The references under the species are to previous figures of the male genitalia.

1. **Poanes viator** Edwards (Fig. 1.)

Scudder, Butt. New Eng., III, plate 37, fig. 10.
Godman, Biol. Cent.-Amer., Rhop., III, plate 94, fig. 1.

Type localities; Northern Illinois (Arthur Christie), ♂: New Orleans (E. Norton), ♀.

The male genitalia of *viator* are quite different from those of any other of the species of *Poanes,* but the parts show some striking resemblances. The uncus ends in a split projection above and hooks below; the valve has the character of that of *melane* and the aedoeagus is like that of *massasoit,* so we believe this species should be retained in the genus *Poanes* where placed by Lindsey.

Records: NEW YORK, Batavia, July; NEBRASKA, Omaha, July, (Leussler); ALABAMA, Mobile, September, (Dukes); FLORIDA, Central (Morrison).

2. **Poanes massasoit** Scudder (Fig. 2.)

Scudder, Butt. New Eng., III, plate 37, figs. 8 and 19 must be in error; they are not *massasoit,* but probably represent *vestris.*

Type locality; Carver, Massachusetts.

Massasoit is the type of the genus *Poanes*. The terminal hooks of the uncus are shorter, stouter and more broadly separated than those of the balance of the genus.

Record: New Jersey, Westville, July (Laurent).

Poanes massasoit form **suffusa** Laurent

Type locality; Westville, New Jersey.

Record: New Jersey, Laurel Springs, July (Laurent).

3. **Poanes hobomok** Harris (Fig. 3.)

Scudder, Butt. New Eng., III, plate 37, figs. 17, 18 (as *Atrytone zabulon*).

Type information; no locality given, probably Massachusetts.

The male genitalia of *hobomok*, *zabulon* and *taxiles* are very close; but there are differences in the shape of the outer portion of the valve and of the toothed terminal processes of the aedoeagus, which are constant in the three species.

Records: Connecticut, Avon, May, June (Williams); Rhode Island, Johnston, May; Pennsylvania, Mount Airy, June (Laurent); Philadelphia, May (Williams); Castle Rock, May; Harvey's Lake June (Skinner); Illinois, Quincy, May (Poling); Nebraska, Omaha, May; Cedar Bluffs, May (Leussler); Michigan, Pequaming, July, August (Hebard); Ontario, Nepigon, August (Skinner); Manitoba, Stony Mount, June (Wallis).

Poanes hobomok form **pocohontas** Scudder (♀)

Type information; Massachusetts and Connecticut.

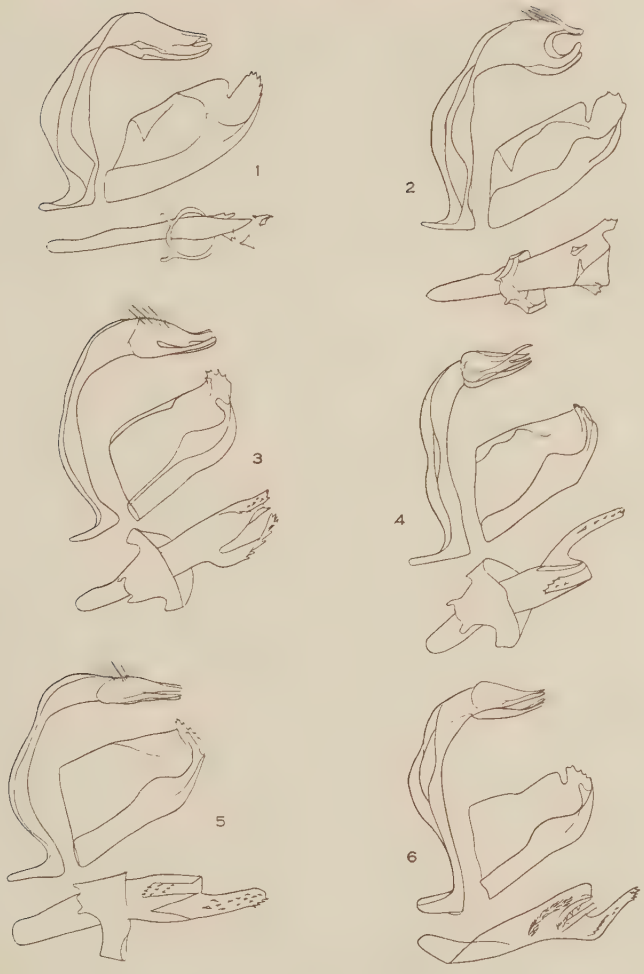
Records: Connecticut, Avon, June (Williams); New York, Axton, Adirondack Mountains, June; Pennsylvania, Mount Airy, (Laurent), Ricketts, June (Skinner), Elwyn (Welles).

4. **Poanes zabulon** Boisduval and LeConte (Fig. 4.)

Godman, Biol. Cent.-Amer., Rhop., III, plate 94, fig. 7.

Type information; not given.

Records: Pennsylvania, Elwyn (Welles); Philadelphia, May (Williams); Mount Airy, May (Laurent); New Jersey, Gloucester, May (Williams); Westville, June (Laurent); Maryland, Havre de Grace, June (Williams); Illinois, Quincy, April, May (Poling); Tennessee, Nashville, August.



1. *Poanes viator*, Batavia, New York. 2. *Poanes massasoit*, Westville, New Jersey. 3. *Poanes hobomok*, Avon, Connecticut. 4. *Poanes zabulon*, Havre de Grace, Maryland. 5. *Poanes taxiles*, Chimney Gulch, Colorado. 6. *Poanes melane*, Southern California. (All × 15.)

5. **Poanes taxiles** Edwards (Fig. 5.)

Type information; Arizona, Colorado, Nevada, California.

Records: NEBRASKA, Harrison, July (Leussler); COLORADO, Chimney Gulch, Golden, June (Oslar); Clear Creek Canyon, June, July (Oslar); UTAH, City Creek Canyon, July (Skinner); Provo, July (Spalding); Sierra La Sal Mountains, July (Skinner); NEW MEXICO, Jemez Springs, June, July (Woodgate); Socorro County, July; Santa Fé Canyon, 9000 feet; Rio Ruidoso, White Mountains, July (Townsend); Fort Wingate, July (Woodgate); ARIZONA, Baboquivari Mountains, July (Poling); Chiricahua Mountains, June (Stone); Mount Graham (Morrison); Huachuca Mountains, August (Skinner); Gila County, June (Poling).

6. **Poanes melane** Edwards (Fig. 6.)

Godman, Biol. Cent.-Amer., Rhop., III, plate 94, fig. 32.

Type information; California, 1 ♂, 1 ♀. Coll. Tryon Reakirt.

The aedoeagus of *melane* is provided with two toothed terminal processes as in the preceding species, and carries in addition a floating bundle of hair-like spines.

Records: CALIFORNIA, Pomona, August, September (Hewlett); Ventura County, June; Pasadena, April, May (Grinnell); Upland, September, October (Hewlett); Calaveras County, September; Kaweah; Yosemite, (Cresson).

7. **Poanes aaroni** Skinner (Fig. 7.)

Type locality; Cape May, New Jersey. Type in the collection of the Academy of Natural Sciences of Philadelphia.

In *aaroni* the aedoeagus ends in two stout teeth, and there is a floating bundle of tooth-like spines.

Records: NEW JERSEY, Anglesea, June, August (Skinner); Corson's Inlet, June (Williams).

Poanes aaroni race **howardi** Skinner

Type locality; Georgiana, Florida. Type in the collection of the Academy of Natural Sciences of Philadelphia.

The male genitalia of *howardi* seem to be identical with those of *aaroni*.

8. **Poanes yehl** Skinner (Fig. 8)

Type locality, Florida (Strecker Coll.).

The aedoeagus carries a floating bundle of tooth-like spines and this and the teeth attached only by membrane, are shown in the drawing outside of the chitinous aedoeagus. These floating objects are frequently forced out of the aedoeagus when the cover glass is pressed on the slide holding the genitalic mount or even during dissection.

Records: TENNESSEE, Nashville, August; SOUTH CAROLINA, Columbia, June; GEORGIA, Atlanta.

9. **Choranthus radians** Lucas (Fig. 9.)

Type locality, Cuba. The type locality of *Pamphila streckeri* Skinner[1] is Florida, and the type is in the Strecker Collection at the Field Museum in Chicago.

The genus *Choranthus* was erected for *radians* by Scudder,[2] and we place in this genus *haitensis* and *Hesperia vitellius*, which are provided with similar peculiar male genitalia.

In *radians* the secondaries are dark brown below and streaked over the veins with orange in strong contrast with the ground color.

The uncus is remarkable in that the upper projection, split slightly at its terminus, carries on each side a strong hook curved upwards. The usual lower hooks are replaced by a leaf-like plate, long, narrow, and with some serrations at the outer end. The valve and aedoeagus are quite simple in structure.

Record: CUBA, Guantanamo, February (Skinner), August (Ramsden).

10. **Choranthus haitensis** Skinner (Fig. 10.)

Type information: described[3] from a number of specimens from Haiti and Santo Domingo. The only definite localities are Samaná Bay, Santo Domingo (Dr. W. L. Abbott), the *type* male from Port de Paix, Haiti, VII, 27, 1917 (Dr. W. L. Abbott),

[1] Ent. News, IV, p. 211, (1893). Placed in the synonymy in Ent. News, XXVIII, p. 82, (1917); also see Ent. News, XXXI, p. 186, (1920), where *radians* is redescribed.

[2] Ann. Rep. Peabody Academy Science, 1871, p. 79.

[3] Ent. News, XXXI, p. 187, (1920).

and a female with the same data. The type is in the collection of the Academy of Natural Sciences of Philadelphia.

Mr. Philip Laurent caught a male April 3 and a female April 6, 1901, at Gunntown, Levy County, Florida. It closely resembles *radians* but the secondaries below are of a uniform deep ocher color.

The male genitalia are similar in structure to those of *radians*, the hooks on the upper projection of the uncus much larger and the leaf-like lower lobe spatulate and tapering to its outer end where it is very broad.

11. **Problema byssus** Edwards (Fig. 11.)

Scudder, Can. Ent., XIX, p. 47, (1887) (as *Atrytone kumskaka*).

Type locality. "From 20 examples, 13 ♂, 7 ♀, received from Indian River, Florida."

Type locality of *Atrytone kumskaka* Scudder, "Iowa—2 ♂ and 3 ♀ from the Western States."

Scudder's description and figure of the male genitalia of *kumskaka* as well as the description of the insect agree with those of *byssus*. The identity of *byssus* and *kumskaka* is called attention to by Skinner.[4]

We here erect the genus **Problema** (*projecting*, referring to the upper arm of the valve), with this species as the type. It differs from the species with which it has been associated by the absence of a stigma in the male and the peculiar structure of the male genitalia, which is unlike that of any hesperiid we have seen. The upper terminals of the uncus are short and beaked, the lower ones project beyond the upper ones and are broad and kidney shaped; the valve is broad and with peculiar terminals shown in the drawing, the aedoeagus is short and stout with a large terminus bearing four dentated flanges.

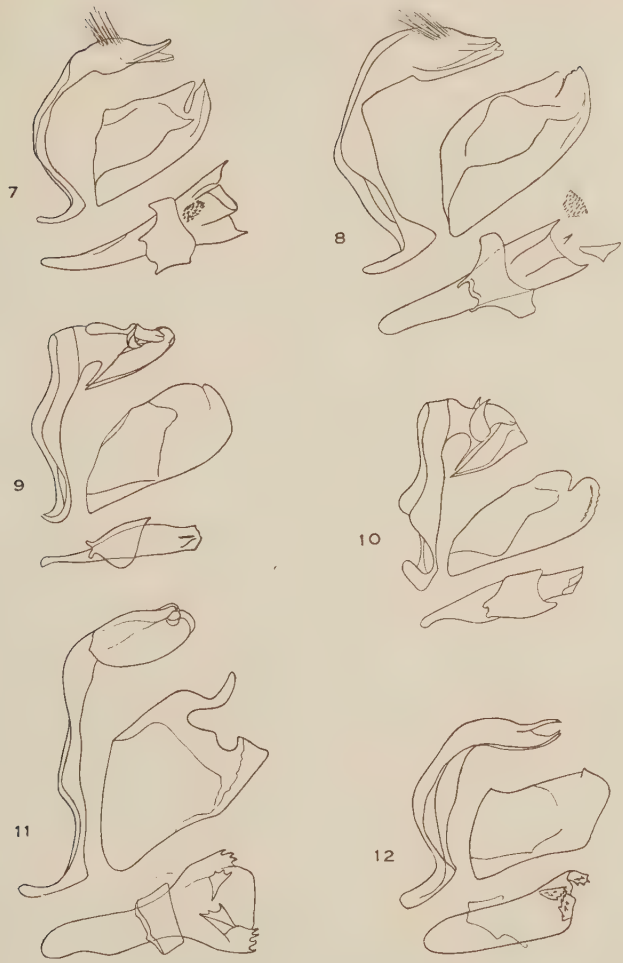
Records: FLORIDA, Indian River, May; Georgiana, October (Wittfeld); ALABAMA, Spring Mill, Mobile County, May (Dukes).

12. **Problema ? bulenta** Boisduval and Le Conte

Type information; North America.

The insect figured by the original authors seems to be unique. We cannot, however, consider it the same as *byssus*. To do this one must assume the illustration to be a very poor drawing,

[4] Ent. News, XXXII, p. 276, (1921).



7. *Poanes aaroni*, Anglesea, New Jersey. 8. *Poanes yehl*, Nashville, Tennessee. 9. *Choranthus radians*, Guantanamo, Cuba. 10. *Choranthus haitensis*, Santo Domingo. 11. *Problema byssus*, Indian River, Florida. 12. *Atrytone arogos*, Florida. (All × 15.)

and the balance of the author's figures are excellent. It is quite possible that the species is still in existence, but our collectors have not as yet found its natural habitat, probably in Georgia, a state where there are few collectors.

13. **Atrytone arogos** Boisduval and Le Conte (Fig. 12.)

Type locality; North America.

The uncus terminates in a double beak above and two arms below. The valve is very simple. The aedoeagus ends in four chitinous plates armed with small stout teeth.

Records: Nebraska, Omaha, June, July (Leussler); McCook, July (Shoemaker); Florida, Miami, July; Alabama, Whistler, July (Dukes).

14. **Atrytone logan** Edwards (Fig. 13.)

Scudder, Butt. New Eng., III, plate 37, fig. 11.
Godman, Biol. Cent.-Amer., Rhop., III, plate 94, fig. 6 (as *Atrytone delaware*).

Type localities: "Lansing, Michigan, from Mr. Miles, Philadelphia from Mr. Newman."

The uncus has split beaked projections above and arms below. The aedoeagus is provided with two floating external arms provided with more or less teeth on their extremities, and also carries two long bundles of hair-like spines.

Records: South Dakota, Volga, July, August (Truman); Nebraska, Sioux County, July (Leussler); Iowa, Grinnell, July (Willard); Connecticut, Avon, June (Williams); New Jersey, Westville, July (Laurent); Arkansas, Hope, July (Knobel); Florida, Enterprise, April (Laurent); Dunedin, March (Blatchley); Georgiana (Wittfeld); Key West (Morrison); Palatka, May (Bradley); Rockledge.

Atrytone logan form **lagus** Edwards

Type information. "I formerly received a single male of this little species from Mr. Boll, taken in western Texas; and recently Mr. Neumoegen has brought another male from Southern Colorado, taken at Oak Creek Canon." W. H. Edwards.

We agree with Lindsey that *lagus* is a pale form of *logan* with a very restricted fuscous border. The male genitalia of such specimens do not differ from those of the darker typical ones.

15. **Atrytone arpa** Boisduval and Le Conte (Fig. 14)

Type locality; North America.

The male genitalia of *arpa*, *pilatka* and *dukesi* are very similar but there are differences in the shape of the valve and the terminal processes of the aedoeagus.

The stigma is similar in the three species (two separate spots) and differs from that of the following three species (an interrupted dash). The male genitalia differ from those of the preceding species (*arogos* and *logan*); but show a close relationship to the following species, i. e. *dion*, *conspicua* and *bimacula*.

Arpa has a pair of strong large sharp teeth at the terminal of the aedoeagus.

Record: Florida, Miami, January (Hebard).

16. **Atrytone pilatka** Edwards (Fig. 15.)

Type locality. "From one male taken at St. Augustine, Florida."

We use the original spelling although Edwards corrected it afterwards to *palatka*, the name of a town some distance from St. Augustine. The Indian name may be spelled phonetically either way

Pilatka has a pair of slender but strong toothed processes at the terminal of the aedoeagus.

Records: Florida, Miami, March (Williams), February, November (Laurent); Alabama, Mobile, August (Dukes).

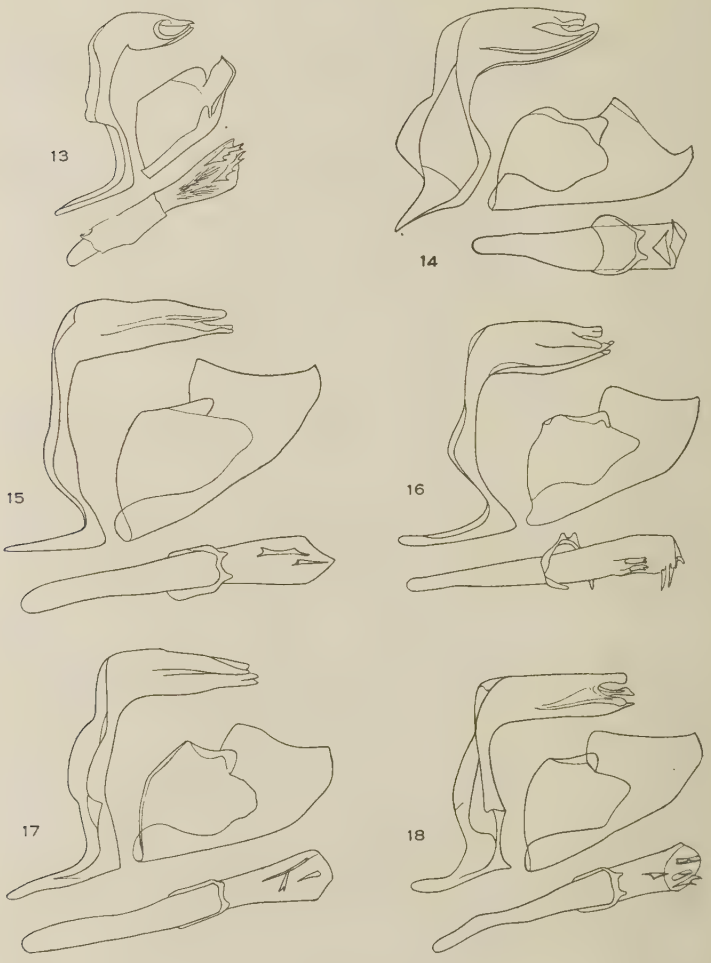
17. **Atrytone dukesi** Lindsey (Fig. 16.)

Type locality: described[5] from four males, all taken in Mobile County, Alabama, in 1922 by W. C. Dukes. Type taken August 6, other dates August 27 and 29.

We have a female which we associate with our male *dukesi* which is darker than the females of *pilatka*, and with the orange areas more restricted, but some others may be faded females of *dukesi* or females of *pilatka*.

There are five toothed processes at the terminus of the aedoeagus.

[5] Ent. News, xxxiv, p. 209, (1923).



13. *Atrytone logan*, Volga, South Dakota. 14. *Atrytone arpa*, Florida. 15. *Atrytone pilatka*, Miami, Florida. 16. *Atrytone dukesi*, Mobile, Alabama. 17. *Atrytone dion*. Locality? 18. *Atrytone conspicua*, Philadelphia, Pennsylvania. (All × 15.)

18. **Atrytone dion** Edwards (Fig. 17.)

Type information. "Southern Shore of Lake Michigan, in Indiana from Mr. Chas. E. Worthington; also from Mr. J. A. Moffat, of Hamilton, Ontario."

The long aedoeagus carries at its terminal four slender processes with one or two teeth.

Records: NEBRASKA, Omaha, July (Leussler); NEW YORK, Batavia, July; NEW JERSEY, Anglesea, August.

Atrytone dion race **alabamae** Lindsey

Type locality: Mobile County, Alabama, June 25 (Dukes). A dark form of *dion*.

19. **Atrytone conspicua** Edwards (Fig. 18.)

Scudder, Butt. New Eng., III, plate 37, fig. 30 (as *Limochores pontiac*).

Type locality: "Lansing, Michigan, from Mr. Miles."

The aedoeagus carries four toothed processes.

Records: NEBRASKA, Omaha, July (Leussler); IOWA, Grinnell, (Willard); PENNSYLVANIA, Philadelphia (Skinner); NEW YORK, Staten Island (Davis); NEW JERSEY, Elizabeth, July.

20. **Atrytone bimacula** Grote and Robinson (Fig. 19.)

Scudder, Butt. New Eng., III, plate 37, fig. 29.

Type information: "Atlantic District. (Philadelphia!)"

The aedoeagus ends in two stout teeth.

Records: PENNSYLVANIA, Poyntella, June; IOWA, Grinnell, June (Willard); NEBRASKA, Omaha, July (Leussler).

21. **Atrytone vestris** Boisduval (Fig. 20.)

Type information, California.

The male genitalia are very similar to those of the preceding species of this genus. The aedoeagus carries at its terminus two stout teeth.

Records: CALIFORNIA, Upper Soda Springs, Siskiyou County, June (Fox); OREGON, Fort Klamath; WASHINGTON, Olympia, July; COLORADO, Clear Creek Canyon, June; Halls Valley, August; Kenosha Pass, August (all Oslar); Glenwood Springs, July (Skinner); Chimney Gulch, June; Manitou, July; NEW MEXICO, Jemez Springs, June, July (Woodgate); Las Vegas, July (Snow); TEXAS, Round Mountain, June, July, September; New Braunfels, May (Schaupp); Corpus Christi, (Aaron); San

Antonio; Arkansas, Hope, July (Knobel); Nebraska, Harrison, July (Leussler); Indiana, Bluffton, August (Williamson); South Dakota, Volga, July (Truman); Illinois, Quincy, May (Poling); Tennessee, Nashville, August; North Carolina, Cranberry, July (Thomas); Mitchell County; Georgia, Tifton, May; Pennsylvania, Philadelphia, June; New York, Beaverkill, August (Cresson); Connecticut, Avon, July (Williams); Ontario, Toronto; Manitoba, Husavick, June (Wallis); British Columbia, Goldstream, July.

Atrytone vestris form **immaculatus** Williams

Type locality; Jemez Mountains, New Mexico.

This is, as the name implies, without hyaline spots. The type is in the collection of the Academy of Natural Sciences of Philadelphia.

22. **Atrytonopsis loammi** Whitney (Fig. 21.)

Type locality; Jacksonville, Florida.

The male genitalia of this species and the four following are very much alike. The uncus carries two rather widely separated beak-like projections above and two arms below, of about the same length. The chitinous outer end of the aedoeagus is serrated on the two sides and there are two floating stout teeth with a single point or with two or more points. The valvae are only slightly different in shape. The similarity indicates a close relationship between these species which can hardly be determined from the male genitalia alone.

The upper sides of the primaries in *loammi* and *hianna* are practically alike, but the two species are readily separated by the white markings on the under side of the secondaries in *loammi*.

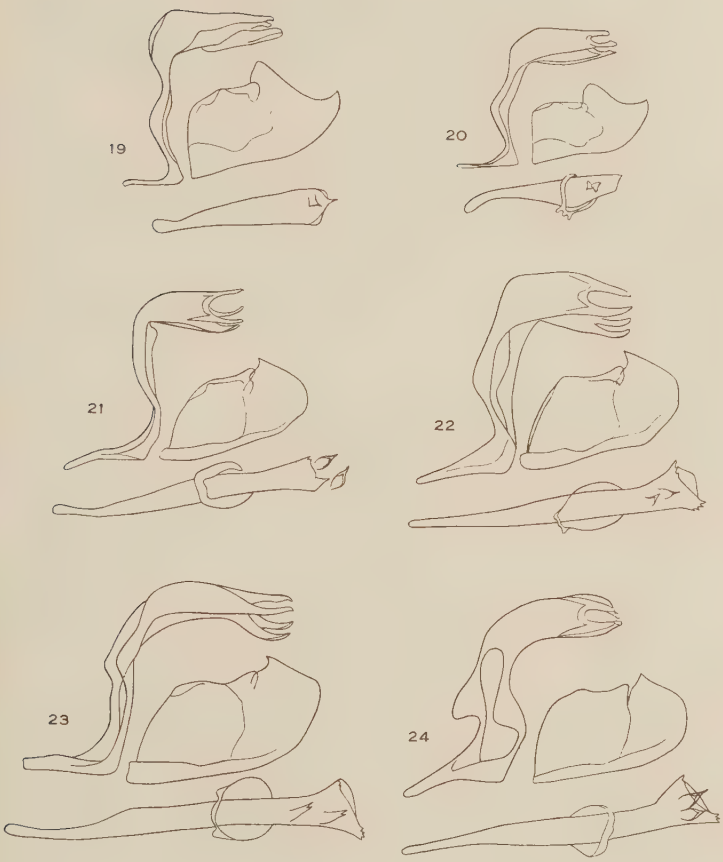
Records: Florida, Miami, January (Williams); Biscayne Bay; Tarpon.

23. **Atrytonopsis hianna** Scudder (Fig. 22.)

Scudder, Butt. New Eng., III, plate 37, fig. 36.

Type information. "This fine species has been taken by Mr. Sanborn at Quincy and Dorchester, Mass."

Hianna looks much like the western *deva*, but can be separated by its smaller size and the absence of the white fringes of the inferior wings in *deva*.



19. *Atrytone bimacula*, Grinnell, Iowa. 20. *Atrytone vestris*, Round Mountain, Texas. 21. *Atrytonopsis loammi*, Miami, Florida. 22. *Atrytonopsis hianna*, Dewey Lake, Nebraska. 23. *Atrytonopsis deva*, Chiricahua Mountains, Arizona. 24. *Atrytonopsis pittacus*, Mount Graham, Arizona. (All × 14.)

Records: Connecticut, Avon, June (Williams); New York, Centre, May, June (Hill); Illinois, Riverside, May; Iowa, Grinnell, May; Nebraska, Dewey Lake, Cherry County, June (Leussler); Texas, Miami, May; Oklahoma, Woodward, May.

24. **Atrytonopsis deva** Edwards (Fig. 23.)

Godman, Biol. Cent.-Amer., Rhop., III, plate 95, fig. 9.

"From a single example received from Prescott," (Arizona).

The two spots on the primaries, the second usually crescent-shaped, the white fringes, and the secondaries below often immaculate, serve to distinguish this species.

Records: Arizona, Mount Graham (Morrison); Huachuca Mountains (Poling); Chiricahua Mountains (Stone); Baboquivari Mountains, May (Poling).

25. **Atrytonopsis pittacus** Edwards (Fig. 24.)

Godman, Biol. Cent.-Amer., III, plate 95, fig. 13.

Type locality: "3 ♂, 1 ♀, Fort Grant, Graham Mts., Arizona."

Pittacus has a band of four white dots on the upper side of the secondaries. It is a smaller species than *edwardsi* and could readily be confused with it.

Records: Arizona, Mount Graham (Morrison); Baboquivari Mountains, June (Poling).

26. **Atrytonopsis vierecki** Skinner (Fig. 25.)

Type locality: "6 ♂, 2 ♀, taken by Henry L. Viereck in Dry Canon, Alamogordo, New Mexico, May 8th to 13th."

The type of this species is in the collection of the Academy of Natural Sciences of Philadelphia. It is lighter in color than *deva* and the two spots at the outer side of the discal cell will serve to separate it from *deva*.

Record: New Mexico, Jemez Mountains, May (Woodgate).

27. **Atrytonopsis lunus** Edwards

Type information. "Taken in Arizona by Mr. Morrison."

Lunus is close to *deva* but averages larger and the translucent spots are larger. This, and the relatively small size of the head as compared with its near relatives, lead us to consider it a good, distinct species. There are in the collection of the Academy of Natural Sciences of Philadelphia two females from Arizona

(Morrison) and there are three, one of which is marked "type," in the collection of the Brooklyn Museum.

28. **Atrytonopsis python** Edwards (Fig. 26.)

Type locality. "From 1 ♀, Fort Grant, Graham Mts., Ariz."

The spots on typical *python* are yellowish. The male is correctly figured by Lindsey.[6]

The Godman figures[7] do not represent *python*, nor do we believe them to be the female of *pittacus*, as all of the females which we have of this species have all of the spots of the male and these spots are larger.

The male genitalia of *python* are similar to those of the preceding species, but both the saccus and the aedoeagus are considerably longer.

Records: Arizona, Chiricahua Mountains, June (Stone); Mount Graham (Morrison); Baboquivari Mountains, May, June (Poling); Gila County, June (Poling).

Atrytonopsis python form **margarita** Skinner

Type locality: "Jemez Springs, New Mexico."

The spots in *margarita* are white or hyaline without the yellowish sheen, and it is somewhat smaller on the average. The male genitalia are the same as those of *python*.

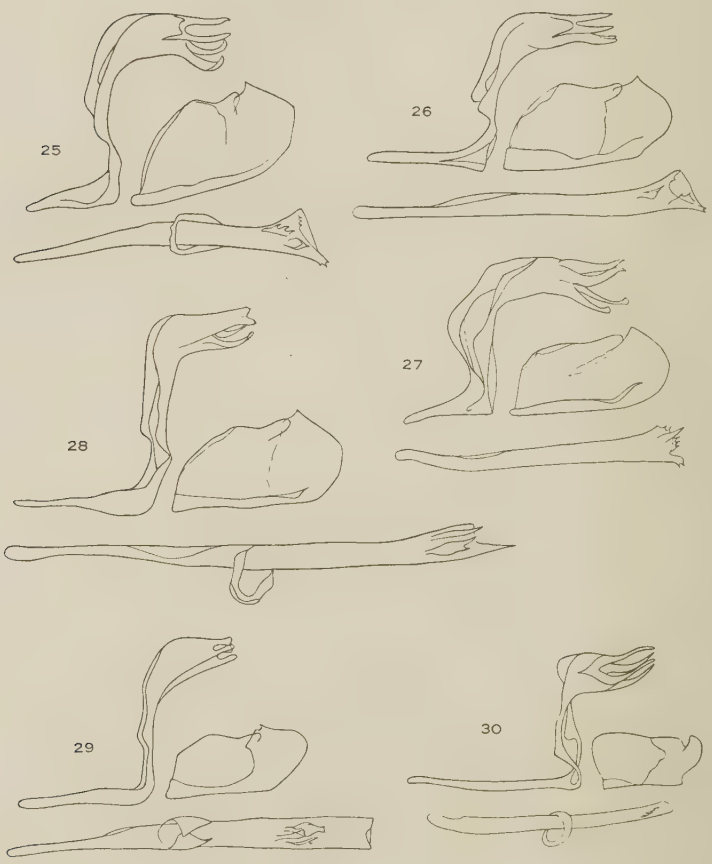
29. **Atrytonopsis cestus** Edwards (Fig. 27.)

Type information. "From 1 ♂, taken by Mr. Morrison in Southern Arizona."

We have examined the type of this species in the collection of the Brooklyn Museum, and possess a single specimen from the Baboquivari Mountains, Pima County, Arizona, April 15th, 1923, taken by O. C. Poling. Our figure of the male genitalia was made from this specimen. This species is related to *A. python*, *edwardsi* and *pittacus*. The translucent spots in *python* are yellow or tinted with yellow and in the other three species are pearl white. *Python* lacks the vitreous spot at the base of the secondaries and the spots are not nearly as sharply defined

[6] Univ. of Iowa Studies in Nat. Hist., IX, plate 1, fig. 1, (1921).

[7] Biol. Cent.-Amer., Rhop., III, plate 95, figs. 14, 15.



25. *Atrytonopsis vierecki*, Alamogordo, New Mexico. 26. *Atrytonopsis python*, Baboquivari Mountains, Arizona. 27. *Atrytonopsis cestus*, Baboquivari Mountains, Arizona. 28. *Atrytonopsis edwardsi*, Baboquivari Mountains, Arizona. 29. *Oligoria maculata*, Venice, Florida. 30. *Lerema accius*, San Antonio, Texas. (All × 14.)

as in *cestus*. The outer vitreous spot on the inferior wings of *cestus* is out of line and the spots are rectangular, while in *edwardsi* they are nearly round. In *pittacus* the band of spots makes a straight line. The under side of *cestus* is mottled by lighter areas, quite different from its near relatives.

30. **Atrytonopsis edwardsi** Barnes and McDunnough (Fig. 28.)

Type information. "Type ♂ Redington, Ariz." "Type ♀ Baboquivari Mts., Ariz."

The male genitalia are remarkable for the very long aedoeagus and the corresponding length of the saccus. The upper terminal projection of the uncus differs from that of the other species of the genus in that there is only a slight incision between the two terminal stout beaks.

Records: Arizona, Baboquivari Mountains, April, May, June, July, September (Poling); Huachuca Mountains, June.

31. **Oligoria maculata** Edwards (Fig. 29.)

Scudder, Butt. New Eng., III, plate 37, fig. 33.

Type locality. "Taken at New Orleans by Mr. Norton."

The male genitalia resemble those of *Atrytonopsis edwardsi* in general shape of the tegumen, valve, and the elongated saccus and aedoeagus. The lower projections of the uncus, however, are short and spatulate and widely separate.

Records: Florida, Venice (Bonniwell); Miami, February (Williams); Dunedin, April; Rockledge; Georgia, Thomasville; Alabama, Whistler, August (Dukes).

32. **Lerema accius** Abbot-Smith (Fig. 30.)

Scudder, Butt. New Eng., III, plate 37, fig. 12.
Godman, Biol. Cent.-Amer., Rhop., III, plate 99, fig. 44.

Type locality, Georgia.

The male genitalia differ from those treated in this paper in the shape of the valve, the long slender projections of the uncus, the long slender saccus and the simple aedoeagus bearing at its extremity a small floating bundle of hair-like spines.

Records: Florida, Miami, January, February (Hebard); Tampa, January, February (Williams); Palm Beach; Glenwood; Lake George; Alabama, Mobile, September (Dukes); Arkansas,

Hope, August (Knobel); Texas, San Antonio; Tennessee, Roan Station, July (Thomas); South Carolina, Summerville, May (Jones); North Carolina, Cranberry, July, August, September (Thomas); Southern Pines, September (Mance); Pennsylvania, Elwyn (Welles).

STUDIES IN THE ACRIDIDAE OF PANAMA (ORTHOPTERA)

BY MORGAN HEBARD

The present is our fifth contribution to the knowledge of the Dermaptera and Orthoptera of Panama.[1] Since publication of the other papers, only a few small additional collections have been secured in this region. One of these was made by G. H. H. Tate for the author, and one by D. E. Harrower for the Academy of Natural Sciences of Philadelphia. The latter series is, however, of particular interest, as part is from the country to the west of the Volcano of Chiriquí and part from the shore of the Gulf of San Blas. In these sections very little collecting of Orthoptera has ever been undertaken.

In the preparation of the present paper, our recent study of the Acrididae of Colombia[2] has resulted in the location of a number of genera which have been very poorly understood and which, in a number of cases, had a direct bearing on the accurate assignment of certain Panamanian genera. Large unstudied Costa Rican series have also proved of much value.

The material recorded is the property of the United States National Museum, if collected by A. Busck, A. H. Jennings, E. A. Schwarz, W. Robinson or W. Schaus, and is in the author's collection, unless otherwise noted, if collected by D. E. Harrower, G. H. H. Tate, J. Zetek or M. Hebard.

[1] The previous papers are:

"A Contribution to the Knowledge of the Dermaptera of Panama," Trans. Am. Ent. Soc., XLIII, pp. 301 to 334, (1917).

"The Blattidae of Panama," Mem. Am. Ent. Soc., no. 4, pp. 1 to 148, (1920).

"A Note on Panamanian Blattidae, with the Description of a New Genus and Two New Species," Ent. News, XXXII, pp. 161 to 169, (1921).

"Studies in the Mantidae and Phasmidae of Panama (Orthoptera)," Trans. Am. Ent. Soc., XLVIII, pp. 327 to 362, (1923).

[2] "Studies in the Dermaptera and Orthoptera of Colombia. Third Paper. Orthopterous Family Acrididae," Trans. Am. Ent. Soc., XLIX, pp. 165 to 313, (1923).

From careful analysis of past records from Panama, we believe that six species[3] of the Acrididae, in addition to the sixty-seven here recorded, have been validly reported from this country. This gives a total of seventy-three species of grasshoppers for Panama.

We regret that Bruner, in the Biologia Centrali-Americana, has recorded from both North and South America many species which in distribution are confined exclusively to one or the other of these continents. That author has also assumed that the distribution of many species included Panama, which we are convinced do not occur even near this region. Other such cases exist, as that of the South American *Paramastax nigra* by Giglio-Tos, recorded from Mexico, unquestionably in error.

The misleading geographic distributional data given by Bruner is illustrated by the fact that, in the Biologia Centrali-Americana, where only Central American species should have been treated, the following South American genera, which do not occur in that region, are discussed:— *Aeolacris, Prionolopha, Draconata, Prionacris, Opthalmolampis, Dicacarchus, Trybliophorus, Jivarus, Henia, Tetrataenia, Caletes, Aptoceras, Sitalces, Monachidium* and *Agesander.*

In the present study we have found Giglio-Tos' key to the genera of South American Cyrtacanthacrinae of great value, due to the fact that, though the characters used to separate several of its sections are of very questionable value and though it is incorrect in a few places, it is far more satisfactory and comprehensive, and has a bearing on more of the genera here considered, than any other in the literature.

We feel that the most important contribution in the present study, after the more definite knowledge and assignment of the species of Panama and their distribution outside this region, lies in the more definite location of certain little-known genera, such as *Platytettix* Hancock, *Mezentia* Stål, *Legua* Walker, *Poecilocloeus* Bruner and *Anniceris* Stål.

We are more and more convinced that, though the Dermaptera and Orthoptera of the Canal Zone and its immediate vicinity are

[3] These are *Munatia punctata, Eutropidacris cristata, Hisychius festae, Rhicnoderma olivacea, Copiocera specularis* and *Nicarchus erinaceus.* All but two of these are represented by extra-Panamanian material in the Philadelphia Collections.

very well represented in the collections which have been made, the Panamanian list will be vastly increased by work in the western and eastern extremities of this country..

In the present paper one thousand two hundred and seventeen Panamanian specimens are treated, one new genus and thirteen new species being described. As is our custom, Ridgway's "Color Standards and Nomenclature" has been used to indicate the exact coloration.

The Panamanian species are listed below, their known distribution in North America (in its broad sense, including Central America), the West Indies and South America being indicated by asterisks, the presence in a region of closely related species being indicated by an "a."

Species	North America	West Indies	South America	Page
	Acrydinae			
Tylotettix simplex new species	a	—	—	79
Platytettix harroweri new species	—	—	a	81
Platytettix panamae new species	—	—	a	83
Chiriquia serrata Morse	*	—	a	84
Otumba aciculata new species	a	—	a	84
Allotettix peruvianus (Bolivar)	*	—	*	86
Paratettix aztecus (Saussure)	*	—	—	87
Paratettix frey-gessneri Bolivar	a	*	a	87
Paratettix antennatus Hebard	a	a	*	88
Paratettix toltecus (Saussure)	*	a	*	89
Micronotus caudatus (Saussure)	—	a	*	89
Micronotus quadriundulatus (Redt.)	—	*	*	90
Ochetotettix barretti (Hancock)	*	—	—	90
Tettigidea nicaraguae Bruner	*	a	a	91
Scaria fasciata Hancock	*	—	*	91
Paurotarsus insolitus Rehn	—	—	*	91
	Eumastacinae			
Eumastax surdus Burr	*	—	a	92
Eumastax cerciata Hebard	a	—	*	92
	Proscopinae			
Proscopia septentrionalis (Bruner)	*	—	a	93
	Acridinae			
Truxalis brevicornis (Johannson)	*	—	*	93
Amblytropidia insignis Hebard	a	—	*	94
Orphulina balloui (Rehn)	*	*	*	94
Orphulella concinnula (Walker)	*	a	*	95
Orphulella punctata (DeGeer)	*	*	*	96

Species	North America	West Indies	South America	Page
	Acridinae (Cont'd.)			
Leuconotus gorgasi new species	a	—	—	97
Scyllina cyanipes (Fabricius)	a	*	*	98
	Oedipodinae			
Heliastus venezuelae Saussure	a	—	*	99
	Paulininae			
Paulinia acuminata (DeGeer)	—	—	*	100
	Cyrtacanthacrinae			
Munatia punctata Stål	*	—	—	Not treated
Munatia biolleyi Carl	*	—	—	100
Procolpia inclarata (Walker)	*	—	a	101
Argiacris tricristata (Serville)	—	—	*	101
Diedronotus rosulentus (Stål)	*	—	*	102
Taeniopoda reticulata (Fabricius)	*	—	—	103
Chromacris psittacus (Gerstaecker)	*	—	*	103
Lophacris gloriosa new species	a	—	a	104
Tropidacris latreillei (Perty)	*	—	*	106
Eutropidacris cristata (Linnaeus)	—	—	*	Not treated
Nautia flavosignata Stål	a	—	—	107
Taeniophora panamae new species	a	—	a	107
Taeniophora chocoensis Hebard	a	—	*	109
Taeniophora femorata Bruner	*	—	a	109
Taeniophora megacephala Bruner	a	—	a	110
Colpolopha rehni Hebard	*	—	*	102
Hisychius festae Giglio-Tos	—	—	a	Not treated
Rhicnoderma olivaceum Gerstaecker	a	—	—	110
Rhicnoderma magnificum new species	a	—	—	110
Mezentia gibbera Stål	—	—	—	112
Legua crenulata (Stoll)	*	—	—	114
Leptysma insularis (Bruner)	*	a	*	116
Opshomala cylindrodes (Stål)	a	a	*	116
Opshomala goethalsi new species	*	a	a	117
Inusia chipmani Bruner	*	—	a	119
Oxyblepta limbatipennis Stål	—	—	*	119
Cornops longipenne (DeGeer)	—	—	*	120
Copiocera specularis Gerstaecker	*	—	a	120
Copiocera harroweri new species	a	—	a	120
Poecilocloeus rhabdotus new species	—	—	a	123
Leioscapheus gracilicornis Bruner	*	—	—	125
Anniceris nigrinervis Stål	a	—	*	126
Ampelophilus olivaceus (Giglio-Tos)	a	—	—	127
Phaeoparia rotundata Stål	—	—	a	128

Species	North America	West Indies	South America	Page
Cyrtacanthacrinae (Cont'd.)				
Aristia depressicornis Bruner	*	—	a	129
Abracris obliqua (Thunberg)	*	—	*	130
Osmilia flavo-lineata (DeGeer)	*	*	*	131
Vilerna aeneo-oculata (DeGeer)	*	—	*	131
Vilerna corticina new species	a	—	a	132
Nicarchus erinaceus Stål	—	—	—	Not treated
Schistocerca impleta (Walker)	*	—	—	133
Schistocerca paranensis (Burmeister)	*	—	*	135
Schistocerca separata Scudder	*	—	*	135
Aidemona azteca (Saussure)	*	—	*	136
Piezops ensicornis (Stål)	—	—	—	136
Microtylopteryx nigrigena new species	a	—	—	137

Acrydinae

Group *Cladonotae*

Tylotettix simplex new species (Plate VI, figures 1 and 2.)

This little tettigid is the least specialized of the genus, the Nicaraguan *T. sinuatus* (Morse)[4] being almost intermediate in degree of specialization between it and a new Costa Rican species. It differs from both in its smaller size, decidedly narrower interval between the carinae of the frontal costa, greater smoothness of dorsum of pronotum, the caudal extremity of which is almost acute, instead of rounded sub-truncate.

The strongly produced frontal costa at the extremity of the vertex, shield-shaped space between lateral carinae of same, very short antennae and decided, percurrent median carina of the pronotum readily distinguish these from *Platythorus camurus* Morse, with which insect confusion might alone be possible.

Type.—♂; Porto Bello, Panama. August 18 to 22, 1916. (D. E. Harrower.) [Hebard Collection, Type no. 908.]

Size small, form moderately stout. Dorsal ocular width about three-fifths that of vertex. Lateral carinae of vertex very slightly projecting cephalad of eyes, moderately well developed, separated from fastigio-facial carina by only feeble emargination; fastigio-facial carina roundly and strongly produced, much as in *sinuatus* but with ventral section of produced portion less

[4] The type of *sinuatus* is in the author's collection.

truncate, much less produced than in the new Costa Rican species. Forks of frontal costa gradually diverging to opposite antennal bases, then parallel, the width of the area thus formed one-third its length (about twice its length in the other species). Antennae very short, scarcely longer than cephalic femur. Pronotum moderately tectiform, median carina percurrent, arched and weakly cristate cephalad of shoulders, straight caudad; cephalic margin broadly obtuse-angulate produced; disk feebly rugulose, tapering caudad to its sharply rounded, sub-acute apex, which extends to near (or in the series to very slightly beyond) the apices of the caudal femora. Latero-caudal angles of pronotum slanting outward, but not strikingly so, externally rounding weakly to caudal portion, where they terminate in a strongly rounded sub-rectangulation. Scapular area of pronotum and organs of flight absent. Cephalic and median femora with dorsal margins feebly undulate, the former with ventral margin showing a weak distal lobe, the latter with that margin decidedly undulate; these limbs with contour more even than in *sinuatus*. Caudal femora stout, externally with delicate, oblique rugae; dorsal margin moderately lamellate, forming two sharply angulate projections, one at base of genicular area and one in genicular area. Caudal tarsi very short, the third joint much shorter than the metatarsus.

Allotype.— ♀ ; Porto Bello, Panama. March 18, 1911. (A. Busck.) [United States National Museum.]

Agrees closely with male, differing in the somewhat larger size, slightly more robust form and slightly wider vertex. The pronotum has the disk slightly more rugose, with medio-longitudinal carina very slightly more cristate.

General coloration mummy brown, the cephalic and median limbs slightly paler, the cephalic and median femora with a suffused blackish annulus meso-distad. Caudal tibiae with a faintly indicated pale annulus proximad. The female has a large, transverse, oval spot of whitish buff on the pronotum just caudad of the shoulders.

In the early stages the pronotum is more tectate, this being increasingly decided in the first instars when it is very conspicuous, occupying a greater proportionate distance than in the adult, with the caudal produced portion very short. The early stages of *Platytettix harroweri*, here described, show decided convergence toward the pronotal type found in *Tylotettix*, for in that genus the pronotum is likewise strongly and suddenly cristate cephalad.

The measurements of the type are given first: length of body, ♂, 8 to 7.2; ♀, 9: length of pronotum, ♂, 8 to 7.8; ♀, 8: width

between apices of latero-caudal angles of pronotal lateral lobes, ♂, 3.4 to 3.3; ♀, 3.7: length of caudal femur, ♂, 4.8 to 4.8; ♀, 4.9 mm.

In addition to the described pair, we have before us two paratypic males and three immature individuals (ranging from very small to nearly adult), which bear the same data as the type, as well as two very small immature individuals, taken at Gatun, Canal Zone, in August.

PLATYTETTIX Hancock

From comparison of material, including the types of the genotypic species of this and the genus *Tylotettix*, it is clear that these genera are much more nearly related than has been generally supposed. The Cladonotae are distinguished by Morse in that they lack organs of flight and have the frontal costa widely forked. These are features characteristic of *Platytettix*, which genus we therefore remove from the Metrodorae to the Cladonotae.

Compared with the Central American genus *Tylotettix*, *Platytettix* (including a majority of South American species) differs in the decidedly smaller size of the included species, the pronotum not only more suddenly cristate cephalad but there also inflated and the latero-caudal angles of the pronotal lateral lobes more conspicuous, being more nearly horizontal.

Platytettix harroweri new species (Plate VI, figures 3, 4 and 5.)

This species and *P. panamae*, here described, differ from all previously known species of the genus in having the fastigio-facial carina rounded and strongly produced, as in *Tylotettix*. The interval between the carinae of the frontal costa is also wide, wider than in *P. uniformis* Bruner and very much wider than in the genotype, *P. reticulatus* Hancock.

The pronotal contour in *harroweri* is very similar to that of *reticulatus*, but the ventro-caudal angles of the lateral lobes are rounded, not aciculate, in this feature agreeing with *uniformis* only, of the previously described species.

Type.— ♀; Gatun, Canal Zone, Panama. July 17 to 23, 1916. (D. E. Harrower; in forest.) [Hebard Collection, Type no. 909.]

Size small, medium for the genus, form robust. Dorsal ocular width about two-fifths that of vertex. Lateral carina of vertex projecting as far cephalad as eyes, raised and forming rounded rectangulate projections latero-cephalad, but separated from fastigio-facial carina by an interval where they are obsolete; dorsal surface of vertex with a large, rounded concavity on each side. Fastigio-facial carina roundly and strongly elevated and produced, its cephalic margin nearly perpendicular. Forks of frontal costa weak and gradually diverging, then well separated with carinae lamellate in interantennal area, which is about one and one-half times as long as wide. Antennae very short, no longer than cephalic femur. Pronotum inflated and suddenly cristate in cephalic portion, the lateral outline of this cristation evenly convex, except caudad where the convexity is stronger; flattened and curving very gently ventrad in caudal portion; surface in inflated portion coarsely nodose and with short, but strong, parallel carinae latero-cephalad on disk; surface of disk caudad with medio-longitudinal carina weak but distinct and heavier, irregularly transverse carinae laterad; post-humeral velvety impressed areas present but not very large. Pronotal disk with cephalic margin very faintly obtuse-angulate produced, tapering caudad to its bluntly rounded apex, which forms an angle distinctly less than ninety degrees and reaches almost to the apices of the caudal femora. Latero-caudal angles of pronotal lateral lobes conspicuously horizontal, the external apex broadly rounded and showing scarcely any obtuse-angulation. Scapular area of pronotum and organs of flight absent. Cephalic and median femora with dorsal margins undulate, the former with ventral margin showing a median and a distal dentiform lamellation, the latter with a proximal and a distal lamellation, of which the median is large (this rarely dentiform). Caudal femora stout, external surface with coarse, oblique rugae, particularly meso-distad; dorsal margin moderately lamellate, forming strong and sharply angulate projections at base of genicular area and in genicular area. Caudal tarsi very short, the third joint much shorter than the metatarsus.

General coloration almost uniform mummy brown, the surface with some microscopic particles adhering, due to the presence of very many, very minute, microscopic denticulations. Tibiae and tarsi slightly more reddish brown, the last tarsal joint darkened distad. Abdomen showing traces of vague, slightly paler, longitudinal bands laterad. Posthumeral velvety spots of pronotum black.

The measurements of the type are given first: length of body, 7.7 and 7.9; length of pronotum, 7.2 and 6.6; width between

apices of latero-caudal angles of pronotal lateral lobes, 3.7 and 3.4; length of caudal femur, 4.8 and 4.3 mm.

We have also before us a large immature individual, bearing the same data as the type, and a paratypic female from Cabima, Panama, taken May 22, 1911, by A. Busck, property of the United States National Museum.

Platytettix panamae new species (Plate VI, figures 6 and 7.)

This interesting insect agrees with *P. harroweri* here described, in the features which distinguish these species from all other known forms of *Platytettix*, as discussed under *harroweri*. It differs from *harroweri* strikingly in having the latero-caudal angles of the pronotal lateral lobes sharply acute-angulate produced, the cristation of the pronotum cephalad much less decided and the caudal apex of the pronotal disk sharply acute.

The latero-caudal angles of the pronotal lateral lobes agree best with those of *P. gibbinotus* Bruner, but are more acute and thus are nearly as acute as in *P. reticulatus* Hancock, though not as strongly produced as in that species.

Type.— ♀ ; Porto Bello, Panama. February 19, 1911. (A. Busck.) [United States National Museum.]

Size small, medium for genus; form moderately robust, but comparatively slender for the genus. Dorsal ocular width very slightly over half that of vertex. Vertex, fastigio-facial carina, frontal costa and antennae as described for *harroweri*. Pronotum weakly inflated and suddenly cristate in cephalic portion, but not as strongly as is usual in *Platytettix*, the lateral outline of this cristation evenly convex; surface flattened and curving very gently ventrad in caudal portion; surface much as in *harroweri*, except that the carinae and nodes are slightly weaker. Pronotal disk with cephalic margin almost transverse, tapering caudad to its apical portion, which is sharply acute-angulate and extends very slightly beyond the apices of the caudal femora. Latero-caudal angles of pronotal lateral lobes conspicuously horizontal, the external apex sharply acute, with its cephalic margin very weakly convex and its caudal margin weakly concave. Scapular area of pronotum and organs of flight absent. Limbs as in *harroweri*.

General coloration almost uniform mummy brown, the surface with minute particles thickly adhering, due to the presence of very many, very minute, microscopic denticulations. Tibiae and tarsi slightly paler and more reddish brown, the tips of the

last tarsal joint blackish. Abdomen showing traces of vague, slightly paler, longitudinal bands laterad. Posthumeral spots obsolete.

♂. Length of body, 7.8; length of pronotum, 7.2; width between apices of angles of pronotal lateral lobes, 4.6; length of caudal femur, 4.9 mm.

The type is unique.

Group *Metrodorae*

Chiriquia serrata Morse

1900. *Chiriquia serrata* Morse, Biol. Cent.-Amer., Orth., II, p. 7, text figs. [♂, Volcan de Chiriqui, Panama; juv. ♂, Castillo, Nicaragua.]

Porto Bello, Panama, II, 19 to 24, 1911, (A. Busck), 5 ♂, 2 ♀, 1 juv.

In all of our material, which now forms a considerable series, the adults show what might be termed an intermediate pronotal development between a caudate and an abbreviate condition.

We believe the insect to be local in distribution but usually a common species where present.

Otumba aciculata new species (Plate VI, figures 8 and 9.)

This distinctive insect is readily distinguished by the prominently aciculate latero-caudal angles of the pronotal lateral lobes and the exceedingly narrow vertex. In the latter feature nearest approach is shown by the Ecuadorean *O. quadrata* Hancock,[5] that species, however, having the vertex broader, produced very slightly cephalad of the cephalic margins of the eyes, with lateral apical carinae prominent and curving to meet the median carina, which is equally prominent at the fastigio-facial carina.

The pale face and broad ventral margins of the pronotal lateral lobes, to and including their lateral projections, in males, suggests the similar but decidedly more contrasting coloration of this sex of the Costa Rican *O. dentata* Hancock.[6]

Type.—♂; Porto Bello, Panama. February 27, 1911. (A. Busck.) [United States National Museum.]

Size small, form moderately broad for the genus. Eyes large and protruding; vertex very narrow, at its apex scarcely over a third the ocular width. Lateral carinae of vertex weak along

[5] Paratypes of *quadrata* are in the author's collection.

[6] The single type of this species is here selected. A male, taken at Juan Viñas, Costa Rica, March, 1902, by L. Bruner, Hebard Collection, Type no. 569.

borders of eyes and gradually converging, curving toward median carina and subobsolete below the narrowly truncate apex of the vertex, so that that portion can not be seen in dorsal aspect. Medio-longitudinal carina delicate and percurrent on vertex, curving into the slightly heavier carina of the frontal costa, which forks narrowly and in lateral aspect is convex produced between the antennae. Antennae elongate, nearly equalling the caudal femur in length. Pronotum with disk flattened and very feebly undulate, granulose with a few small nodes; medio-longitudinal carina delicate but percurrent to near the weakly concave cephalic margin, transverse sulci distinct; caudal portion of pronotum with delicate marginal carinae, slenderly tapering to the acute apex, which projects slightly beyond the caudal femora. Latero-caudal angle of pronotal lateral lobes produced in an elongate, stoutly aciculate projection, which is horizontal, straight and directed slightly caudad. Tegmina small, oval. Wings extending to apex of pronotum. Cephalic and median femora slender, with margins sub-undulate. Caudal femora with moderate, oblique rugae on external surface. Caudal metatarsus and third joint equal in length, an unusual condition in *Otumba*.

Allotype.— ♀ ; same data as type, except taken March 12, 1911. [United States National Museum.]

Agrees closely with male, differing in the larger size, slightly broader form and slightly rougher pronotum, the dorsum of which is more undulate. The eyes are proportionately slightly less protuberant, so that the vertex is distinctly over a third the dorsal ocular width.

General coloration blackish mummy brown; in males the face and a broad band margining the pronotal lateral lobes, to and including the aciculate projection, are buckthorn brown; in females the aciculate projection alone is of this paler color. Abdomen with buffy markings latero-dorsad. Limbs paler than dorsum, the ventro-external face of the caudal femora broadly suffused with black, the portions from this band toward the body much paler, buffy brown. Caudal tibiae suffused, with two broad and slightly paler annuli. Terminal tarsal joints all blackish distad.

The measurements of the type and allotype are given first for their respective sexes. Length of body, ♂, 7 to 6.8; ♀, 8.7 and 9: length of pronotum, ♂, 7.1 to 6.8; ♀, 8.4 and 8.5: width between apices of latero-caudal angles of pronotal lateral lobes, ♂, 4.1 to 4; ♀, 4.7 and 4.9: length of caudal femur, ♂, 4.9 to 4.8; ♀, 5.8 and 5.9 mm.

In addition to the described pair, two male and one female paratypes and three immature individuals, all bearing the same data as the allotype, are before us.

Allotettix peruvianus (Bolivar)

1887. *P[aratettix] peruvianus* Bolivar, Ann. Soc. Ent. Belgique, xxxi, p. 272. [♂, ♀; Pumamarca, Peru.]

Porto Bello, Panama, II,19 to III,21, 1911, (A. Busck), 2 ♂, 2 ♀, 3 juv.

As this is a common species in the higher country of Colombia and Costa Rica, it will probably be likewise found abundantly in such environment in Panama. It has been recorded, with a query, from Colon, Rio Cianati and Punta de Sabana, by Giglio-Tos.

In pronotal form the present genus resembles genera of the Acrydiae, the third tarsal joint equalling the metatarsus in length apparently alone having caused its assignment to the Metrodorae.

Group *Acrydiae* [7]

PARATETTIX Bolivar

1887. *Paratettix* Bolivar, Ann. Soc. Ent. Belgique, xxxi, p. 270. Genotype.—*P. meridionalis* (Rambur), selected by Rehn in 1904.

1900. *Telmatettix* Hancock, Psyche, ix, p. 7. Genotype.—*T. aztecus* (Saussure), selected by Kirby in 1910.

Comparison of material of the two genotypic species noted above might lead one to suppose that two distinct generic units were represented. Close examination, however, shows that the difference which could be considered of generic value, lies almost entirely in the very much narrower vertex of *aztecus*. Taking other species into consideration, we then find that *hesperus* of Morse, described as a species of *Paratettix* and referred to *Telmatettix* by Hancock, belongs to the same phylum. In fact, it is probably a geographic race of *aztecus*, though having a much wider vertex. When we consider that other phyla of *Paratettix* include species with vertices quite as narrow as in *hesperus*, it is evident that this character can not be used here for generic separation.

We therefore indicate the above synonymy, not only from the evidence shown by the large representation of the genus in our

[7] This name should be used in place of Hancock's Tetrigiae.

exotic collections,[8] but also from much cumulative study of the very extensive North American representation which we now have.

Paratettix aztecus (Saussure)

1861. *T[ettix] aztecus* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 400. [Mexico calida.]

1902. *Telmatettix parviverticis* var.[9] nov., Hancock, Tettig. of North Amer., p. 130, pl. IX, figs. 3 and 4. [Balsas and Cocula, Guerrero, Mexico.]

Comparison of the type of *parviverticis* with material recognized as *aztecus* by Hancock, Bruner, Morse, Rehn and ourselves, shows no feature warranting the recognition of a distinct species. Neither do Hancock's descriptions and figures indicate as much difference as is often found to occur within a single species of *Paratettix*.

Limon Plantation, Rio Chagres, Panama, VII, 14, 1918, (Dietz and Zetek; about corn field), 2 ♂, 2 ♀.

Gatun, Canal Zone, Pan., VI, 1915, (D. E. Harrower), 1 juv.: VII, 12 to VIII, 5, 1916, (D. E. Harrower), 1 ♂, 2 ♀.

Corozal, C. Z., Pan., XI, 17, 1913, (Hebard), 1 ♂.

Old Panama, Pan., XI, 13, 1913, (Hebard; beaten from grasses in low spot), 1 ♀.

A single female shows a semi-abbreviate pronotal condition, the others all being caudate. The extremely narrow vertex readily separates this from the other species of *Paratettix* found in Panama.

Paratettix frey-gessnerii Bolivar

1887. *P[aratettix] frey-gessnerii* Bolivar, Ann. Soc. Ent. Belgique, XXXI, p. 276. [♂, ♀; Cuba.]

Porto Bello, Panama, IV, 20, 1912, (A. Busck).

France Field,[10] Cristobal, Canal Zone, Pan., VII, 7 and VII, 18, 1920, (Hebard; bare damp soil and in grasses in low area), 1 ♂, 1 ♀.

[8] Twenty-seven exotic species, at present considered valid and referred to *Paratettix*, are represented in the author's collection.

[9] Hancock did not state to which species he considered this insect referable. We here select as single type of *parviverticis*, a male, taken at Cocula, Guerrero, Mexico, March 12, 1898, by O. W. Barrett, Hebard Collection, Type no. 600.

[10] Through a most unfortunate error this locality has appeared as "Paris Field" in all our previous Panamanian studies.

Plantation Borracho, C. Z., Pan., VII, 10, 1918, (Dietz and Zetek; beaten from grass under papayas), 1 ♂.

Juan Mina Plantation, C. Z., Pan., VII, 13, 1918, (Dietz and Zetek; beaten from grass and cowpeas), 1 ♂, 1 ♀.

Corozal, C. Z., Pan., IV, 1912, (J. Zetek), 1 ♀, [U. S. N. M.].

Old Panama, Pan., XI, 13, 1913, (Hebard; beaten from grasses in low spot), 1 ♂, 1 ♀.

Panama City, Pan., (Zetek; on garbage dump), 1 ♂, [Hebard Cln.].

A single male is of the abbreviate pronotal type, the others all being caudate.

It is of great interest to find this species in Central America, as it was previously known only from the West Indies. Comparison with a large West Indian series proves convincingly the present assignment. The species does not appear to occur northward either in Central America or Mexico.

It may be readily separated from *P. antennatus* Hebard by the short (normal) antennae and from *P. toltecus* (Saussure) and *P. mexicanus* (Saussure)[11] by the much more simple margins of the cephalic and median femora (subundulate in the male, weakly undulate in the female), as well as by less conspicuous differences in pronotal contour.[12]

Paratettix antennatus Hebard

1923. *Paratettix antennatus* Hebard, Trans. Amer. Ent. Soc., XLIX, p. 169, pl. x, fig. 2. [♂, ♀: Andagoya, Antioquia, Colombia; Panama.]

Porto Bello, Pan., II, 25 to IV, 17, 1911 and 1912, (A. Busck), 9 ♂, 2 ♀, 1 juv.

Limon Plantation, Rio Chagres, Pan., VII, 14, 1918, (Dietz and Zetek; about corn field), 1 ♂, 1 ♀.

Gatun, Canal Zone, Pan., VII, 12 to VIII, 22, 1916, (D. E. Harrower), 8 ♂.

Juan Mina Plantation, C. Z., Pan., VII, 13, 1918, (Dietz and Zetek; about corn field), 2 ♂.

[11] This species, as recognized by Rehn and Bruner, we believe correctly, is very near *toltecus*, differing mainly in its smaller size, less robust form and weaker undulation and lobation of the margins of the cephalic and median femora. Material before us represents numerous localities from central Texas to Costa Rica.

[12] The characters given by Bolivar to separate *frey-gessneri* from *mexicanus* do not appear to have much value.

Alhajuela, Pan., IV, 17, 1911 and V, 27, 1912, (A. Busck), 1 ♂, 1 ♀.

Tabernilla, C. Z , Pan., VI, 18, 1907, (A. Busck), 1 ♀.

Zone limit five miles west of Empire, C. Z., Pan., XI, 17, 1913, (Hebard; on damp ground, near forest), 2 ♂.

Paraiso, C. Z., Pan., I, 17 to 29, 1911, (A. Busck), 3 ♂, 1 juv.

Cabima, Pan., V, 25 and 28, 1911, (A. Busck), 2 ♂.

Corozal, C. Z., Pan., XI, 17, 1913, (Hebard), 1 ♂.

San Pablo, C. Z., Pan., III, 29, 1911, (A. H. Jennings), 1 ♀.

All of the present series are of the caudate pronotal type, many, however, showing various degrees of slight reduction.

The antennae are unusually elongate when comparison is made with the American species of the genus, the insect in other respects agreeing more nearly with *P. frey-gessnerii* Bolivar.

A number of immature individuals, taken from November to April, probably also represent this species, the commonest and most generally distributed grouse-locust of the Canal Zone.

Paratettix toltecus (Saussure)

1861. *T[ettix] tolteca* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 401. [♂, ♀; Mexico calida.]

Corozal, Canal Zone, Panama, IV, 1912, (J. Zetek), 2 ♀.

Tabernilla, C. Z., Pan., VII, 25, 1907, (A. Busck), 1 ♂.

Bocas del Toro, Pan., VII, 1 to 10, 1908, (W. Robinson), 2 ♀.

Boquete, Pan., VIII, 15 to 20, 1922, (D. E. Harrower), 1 ♂, 1 ♀, [A. N. S. P.].

All are of the abbreviate pronotal type, except a female from Corozal, which is caudate.

The robust form and lobation, as well as undulation, of the margins of the cephalic and median femora easily distinguish this from the other species of *Paratettix* known from Panama.

Micronotus caudatus (Saussure)

1861. *T[ettix] caudata* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 399. [♂, ♀; Guiana.]

Cabima, Panama, V, 19, 1911, (A. Busck), 1 ♀.

Ancon, Canal Zone, Pan., VI, 1909, (A. H. Jennings), 1 ♀.

This slender and delicate little tettigid was formerly known from Paraguay and the Argentine, northward to the Island of Trinidad, Venezuela and Colombia.[13]

[13] We are unable to verify the record from Ometepe, Nicaragua, by Bruner.

We have recently noted the synonymy of *Tettix gracilis* Bruner and have there compared this insect with *Paratettix antennatus* Hebard (see Trans. Amer. Ent. Soc., XLIX, p. 170, (1923)).

Micronotus quadriundulatus (Redtenbacher)

1892. *T[ettix] quadriundulatus* Redtenbacher, Proc. Zoöl. Soc. London, 1892, p. 208. [♂, ♀; Chateaubelais, Island of St. Vincent, [British West Indies].]

1906. *Micronotus hancocki* Bruner, Journ. New York Ent. Soc., XIV, p. 146. [Island of Trinidad.]

The pronotal undulation developed in this very small grouse-locust is subject to considerable individual variation. A paratype of Bruner's *hancocki* and additional material of the species from Trinidad proves conclusively the synonymy of that name.

Gamboa, Canal Zone, Panama, VII, 17, 1918, (Dietz and Zetek), 1 ♂.

Juan Mina Plantation, C. Z., Pan., VII, 13, 1918, (Dietz and Zetek; from grass and cow-peas), 1 ♀.

Corozal, C. Z., Pan. XI, 17, 1913, (Hebard), 2 ♂, 1 ♀.

Old Panama, Pan., XI, 13, 1913, (Hebard; beaten from grasses in low spot), 2 ♂.

Ochetotettix barretti (Hancock)

1899. *Neotettix barretti* Hancock, Ent. News, X, p. 277. [♂; Tizapan, Distrito Federal, Mexico.]

1900. *Ochetotettix volans* Morse, Biol. Cent.-Amer., Orth., II, p. 9, 3 text figs. [Dos Arroyos, Chilpancingo, Venta de Zapilote, Xucumanatlan and Omilteme, Guerrero, Mexico.]

Morse's *volans* is based on the caudate pronotal type developed in *barretti*.[14] That author was apparently led to describe it as distinct, due to its having a more pronounced caudal sinus of the pronotal lateral lobes. The fact is that this sinus becomes less prominent as reduction in the organs of flight takes place.

Taboga Island, Panama, II, 22, 1912, (A. Busck).

This specimen shows slightly greater pronotal production than in the typically abbreviate condition.

An unrecorded Costa Rican series before us, indicates that the species probably has a continuous distribution southward from the Distrito Federal, Mexico to Panama.

[14] Cotypes of *volans* and the type of *barretti* are in the author's collection.

Group *Batrachideae*

Tettigidea nicaraguae Bruner

1895. *Tettigidea nicaraguae* Bruner, Bull. Lab. Nat. Hist. Univ. Iowa, III, p. 62, pl. III, figs. 3a and 3b. [♂, ♀; Nicaragua.]

Corozal, Canal Zone, Panama, 1911, (J. Zetek), 1 ♂, [Hebard Cln.].

This specimen has the pronotum abbreviate.

The species is now known to occur from the states of Vera Cruz and Morelos, Mexico to Panama.

Scaria fasciata Hancock

1907. *S[caria] fasciata* Hancock, Trans. Ent. Soc. London, 1907, p. 244. [♂,] ♀; Cachabe, Ecuador.]

Buena Ventura, Panama, III, 10, 1911, (A. Busck), 1 ♂; V, 19, 1911, (A. Busck), 1 juv.

Porto Bello, Pan., II, 15 to IV, 21, 1911 and 1912, (A. Busck), 7 ♂, 2 ♀, 2 juv.

Upper Rio Pequeni, Pan., III, 1909, (A. H. Jennings), 1 ♂.

Rio Trinidad, Pan., III, 5 to V, 2, 1911, (A Busck), 2 ♂, 4 ♀.

We have recently shown that this species is found from the Rio Los Sabalos, Nicaragua to Cachabe, Ecuador,[15] being the only species of this South American genus known to have a distribution which extends into tropical North America.

Paurotarsus insolitus Rehn

1916. *Paurotarsus insolitus* Rehn, Trans. Amer. Ent. Soc., XLII, p. 271, pl. XV, figs. 36, 37 and 38. [♀; Madeira-Mamoré Railroad Camp No. 43, Rio Madeira, Brazil.]

Paraiso, Canal Zone, Panama, I, 18, 1911, (E. A. Schwarz), 1 ♂.

This specimen is very dark, mummy brown flecked with prout's brown. Though of the caudate pronotal type, the pronotum is less strongly caudate than in any male of a very large unrecorded Amazonian series before us.

Length of body, 11.8; length of pronotum, 13.8; width between lateral apices of pronotal lateral lobes, 4; length of caudal femur, 7.1 mm.

[15] Trans. Amer. Ent. Soc., XLIX, p. 177, (1923). Comparison is there made with *S. hamata* (DeGeer). The present species is also represented in the unstudied Costa Rican collections before us.

The original description does not give the following important difference from *P. ruficornis* (Walker).[16] In *insolitus* the ventrocaudal portion of the pronotal lateral lobes is rounded rectangulate and, unlike in *ruficornis*, projects conspicuously ventrolaterad.

The present record constitutes the first for the genus outside of South America (including the Island of Trinidad).

Eumastacinae

Eumastax surdus Burr

1899. *Eumastax surda* Burr, An. Soc. Española Hist. Nat., xxviii, p. 264. [♀; Chiriqui, Panama (nec Peru).]

Guamina, Rio Chagres, Panama, III, 5, 1922, (G. H. H. Tate), 1 ♂.

It is interesting to find two tropical American grasshoppers of the same genus, identical in almost all other features, but differing very widely in the male genitalia, in low country, separated by but a brief distance and in the same life zone. Such is true for *surdus* and *E. cerciata* Hebard.

Eumastax cerciata Hebard

1923. *Eumastax cerciata* Hebard, Trans. Amer. Ent. Soc., xlix, p. 178, pl. xi, figs. 4 and 5. [♂, ♀; Porto Bello, Panama.]

Porto Bello, Panama, II, 19 to IV, 18, 1911 and 1912, (A. Busck), 9 ♂, 9 ♀, *type*, *allotype* and *paratypes*, 3 juv.

Gatun, Canal Zone, Pan., VIII, 6 to 22, 1916, (D. E. Harrower), 1 large juv. ♀.

[16] Hancock's *P. amazonus* is a synonym of *ruficornis*. This we have been able to determine through the kindness of Mr. B. Uvarov. Material representing the same species as the type of *amazonus*, in the author's collection, was sent to him for comparison with Walker's type. The slight differences reported we find to be due to individual variation, from comparison with the large Amazonian series at hand, and we are able in consequence to establish this synonymy. Mr. Uvarov has further informed us that the material of *P. insolitus*, which we sent him, is distinct from any of the determined grouse-locusts in the British Museum.

The male and female types of *Paurotarsus rugosus* Bruner, belonging to the Bruner Collection, are also before us. Comparisons show that name to be also a synonym of *ruficornis*. The Trinidad specimens agree in all diagnostic features with our Amazonian series, but are distinctly less caudate than the majority. One individual from Pará, Brazil, is, however, of a distinctly abbreviate pronotal phase.

This species is also known from the Colombian Chocó. It closely resembles *E. surdus* Burr, its falcate male cerci alone showing great differentiation.

Proscopinae

Proscopia septentrionalis (Bruner)

1905. *Taxiarchus septentrionalis* Bruner, Ent. News, xvi, p. 313. [Juv. ♀ (nec ♂), ♀;[17] Pozo Azul [de Pirrís], Costa Rica.]

The present insect has the definition between pronotum and prosternum slightly more distinct than in the majority of the species of *Proscopia*. On the strength of this feature alone, it was originally referred to *Taxiarchus*. That genus was erected for a single species which, in addition to this feature, shows difference from the forms assigned to *Proscopia* by Bruner only in having the mesopleura dentate. As a result, we believe *Taxiarchus* to have been based on insufficient grounds and assign it to synonymy under *Proscopia*.

Gatun, Canal Zone, Panama, VII, 25 to 31, 1916, (D. E. Harrower), 1 large juv. ♀; VIII, 6 to 22, 1916, (D. E. Harrower; in forest), 1 ♂.

This large twig-like grasshopper is of particular interest in being the only species of the subfamily known from North America, the Proscopinae being otherwise strictly South American.

Acridinae

Group *Hyalopteryges*

Truxalis brevicornis (Johannson)

1764. [*Gryllus*] *brevicornis* Johannson, Amoenit. Acad., vi, p. 398. [North America.]

Porto Bello, Panama, III, 4, 1911, (A. Busck), 1 ♀.

Gatun, Canal Zone, Pan., VII, 1 ♀, [A. N. S. P.]; VII, 12 to VIII, 5, 1916, (D. E. Harrower), 10 ♂, 4 ♀, 3 juv.

Rio Trinidad, Pan., V, 2 to VI, 1, 1911 and 1912, (A. Busck), 2 ♂, 2 ♀.

Lion Hill, C. Z., Pan., VII, 26, 1907, (A. Busck), 1 ♂.

Zone limit five miles west of Empire, C. Z., Pan., XI, 14, 1913, (Hebard), 1 ♂.

[17] We here select the described adult female as single type of this species, Hebard Collection, Type no. 233.

Paraiso, C. Z., Pan., I, 29, 1911, (A. Busck), 1 ♂.

Bocas del Toro, Pan., VII, 1 to 10, 1908, (W. Robinson), 2 ♂.

La Chorrera, Pan., V, 17, 1912, (A. Busck), 1 ♂.

Panama City, Pan., (J. Zetek), 3 ♀, 1 juv. ♀, [Hebard Cln.].

This species has recently been discussed in considerable detail.[18] It has been recorded from Tin-Tin, Colon and Punta de Sabana by Giglio-Tos as *Metaleptea brevicornis* (Linnaeus).[19]

Group *Amblytropidiae*

Amblytropidia insignis Hebard

1923. *Amblytropidia insignis* Hebard, Trans. Amer. Ent. Soc., XLIX, p. 198, pl. XI, figs. 18 and 19. [♂, ♀; Gatun and five miles west of Empire, Canal Zone, Panama; Hacienda Cincinnati, Susumuco and Villavicencio, Colombia.]

David, Chiriqui, Panama, VIII, 10, 1922, (D. E. Harrower), 1 ♂, [A. N. S. P.].

France Field, Cristobal, C. Z., Pan., VII, 7, 1920, (Hebard; very scarce on edge of forest), 1 ♀, 1 large juv.

Gatun, Canal Zone, Pan., VII, 12 to VIII, 22, 1916, (D. E. Harrower), 40 ♂, 16 ♀, *type*, *allotype* and *paratypes*, 8 juv.

Guamina, Rio Chagres, Pan., III, 4, 1922, (G. H. H. Tate), 2 ♂, 1 ♀.

Zone limit five miles west of Empire, C. Z., Pan., XI, 14, 1913, (Hebard; among grasses in open spot in heavy forest), 1 ♂.

This handsome insect is also known from Colombia. It has been, almost certainly, recorded by Giglio-Tos as *A. ferruginosa* Stål, from Punta di Sabana, Colon and Tin-Tin, Panama.

Group *Orphulellae*

Orphulina balloui (Rehn)

1897. *O[rphulina] pulchella* Giglio-Tos (not of Giglio-Tos, 1894), Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, no. 301, p. 2. [♂, ♀; Lake Pita, Darien, [Panama]; Cartagena, Colombia.]

1905. *Orphulella balloui* Rehn, Ent. News, XVI, p. 178. [♂, ♀; Bay Estate, Barbados, British West Indies.]

Bruner, in the Biologia, determined material of this insect from Ruatan Island, Honduras, as Walker's *Stenobothrus arctatus*. Mr. B. Uvarov has kindly compared that material with the

[18] Trans. Amer. Ent. Soc., XLVIII, pp. 103 to 108, map 2, pl. IV, fig. 10, (1922).

[19] Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, no. 301, p. 1, (1897).

type of Walker's species, which latter is clearly distinct. It is probable that Walker's *arctatus* will prove to be a synonym of *Orphulella punctata* (DeGeer).

Comparison with a recorded series of *Orphulina pulchella* Giglio-Tos, from Sapucay, Paraguay, shows that insect to be extremely closely related, but apparently separable by the slightly more slender and graceful form, with depth of head and pronotum appreciably less and angulation of pronotal disk slightly less distinct. Thus *balloui* is slightly but appreciably more Orphulelloid.

Corozal, Canal Zone, Panama, XI, 17, 1913, (Hebard; in grassy spot on forest edge), 2 ♂.

Ancon, C. Z., Pan., XI, 12, 1913, (Hebard; common in short grass in open), 5 ♂, 5 ♀, 1 juv. ♀.

Balboa, C. Z , Pan., VII, 2, 1918, (H. P. Dietz; on Prado), 2 ♂.

Old Panama, Pan., XI, 13, 1913, (Hebard; beaten from grasses in low spot), 1 ♂, 1 ♀.

Panama City, Pan., 1912, (J. Zetek), 1 ♀, [Hebard Cln.].

A pair are brown, the others with dorsal surface green, the majority of the females of the latter phase having the sides partially green. The males have the postocular area, all but a striking buffy ventral margin of the pronotal lateral lobes and sides of the tegmina a rich, dark brown. Such individuals have a much more trim appearance than is ever shown by *Orphulella punctata* (DeGeer) and are, in consequence, more quickly recognizable than the other less distinctive color phases of the species.

Additional unrecorded material from the east and west coasts of Costa Rica is also before us. It appears probable that this insect is peculiar to the grasslands near the sea in Central America, the Lesser Antilles and on the north coast of South America.

Orphulella concinnula (Walker)

1870. *Stenobothrus concinnulus* Walker, Cat. Dermapt. Saltat. British Mus., IV, p. 759. [♂; Pará, [Brazil].]

1870. *Stenobothrus rugulosus* Walker, Cat. Dermapt. Saltat. British Mus., IV, p. 760. [♂; Santarem, [Brazil].]

1904. *Linoceratium boucardi* Bruner, Biol. Cent.-Amer., Orth., II, p. 84. [♂, ♀; Rio Sarstoon, British Honduras; Panama; Don (nec San) Diego, Magdalena, Colombia.]

We have recently discussed part of the considerable synonymy of this species under the name *boucardi*.[20]

Through the great kindness of Uvarov the types of Walker have been studied and we are informed by him that *rugulosus* is a synonym of *concinnulus*, comparison with material from us showing that this is the species described by Bruner as *boucardi*.

France Field, Cristobal, Canal Zone, Panama, VII, 7, 1920, (Hebard; in saw grass), 1 ♀.

Gatun, Canal Zone, Pan., VII, 12 to VIII, 22, 1916, (D. E. Harrower), 2 ♂, 5 ♀.

Guamina, Rio Chagres, Pan., III, 4, 1922, (G. H. H. Tate), 1 ♂.

Limon Plantation, Rio Chagres, Pan., VII, 14, 1918, (Dietz and Zetek), 6 ♂.

Juan Mina Plantation, Pan., VII, 13, 1918, (Dietz and Zetek; in grass and cow-peas), 3 ♂.

Tabernilla, C. Z., Pan., VI, 20 and VII, 24, 1907, (A Busck), 1 ♂, 3 ♀.

Cabima, Pan., V, 22, 1911, (A. Busck), 1 ♂.

Culebra Cut, C. Z., Pan., XI, 14, 1913, (Hebard; in scanty grasses on slopes), 2 ♂, 1 ♀.

Paraiso, C. Z., Pan., I, 16 to III, 25, 1911, (A. Busck), 4 ♂.

Corozal, C. Z., Pan., III, 1, 1912, IV, 8, 1909, (Busck; Jennings), 4 ♂.

Old Panama, Pan., XI, 13, 1913, (Hebard; beaten from grasses in low spot), 2 ♂, 1 ♀.

Panama City, Pan., XI, 1913, (J. Zetek), 1 ♂, [U. S. N. M.]; 1 ♂.

The species has a very extensive distribution in South America and is known in North America as far north as British Honduras.

Orphulella punctata (DeGeer)

1773. *Acrydium punctatum* DeGeer, Mém. l'Hist. Ins., III, p. 503, pl. 42, fig. 12. [[♀], Surinam.]

We have recently established the synonymy of *mexicanus*, *walkeri*, *meridionalis* and *costaricensis*.[21] Walker's *Stenobothrus arctatus* is probably also a synonym.

[20] Trans. Amer. Ent. Soc., XLIX, p. 204, (1923).

[21] Trans. Amer. Ent. Soc., XLIX, p. 207, (1923).

This is the most abundant grasshopper in Panama, being found in almost every grassy spot in both cultivated and uncultivated environments. The series of two hundred and thirty-four Panamanian specimens before us shows the insect to be present in the adult condition throughout the year. The following localities are represented; Gulf of San Blas, Porto Bello, France Field near Cristobal, Gatun, Bocas del Toro, Limon Plantation on Rio Chagres, Guamina on Rio Chagres, Juan Mina Plantation, Plantation Borracho, Alhajuela, Paraiso, Culebra Cut, Corozal, Ancon, Balboa, Panama City, Taboga Island, Rio Trinidad, Old Panama, Boquete and David. Giglio-Tos' records of *Orphulella olivacea* (Morse) from Panama and Venezuela are almost certainly referable to this or the preceding species. We have definite knowledge that *olivacea* does not occur in the American tropics.

The insect is extremely plastic. It is generally distributed over the tropical regions of the Americas.

Group *Compsacres*

Leuconotus gorgasi[22] new species (Plate VI, figure 10; plate VII, figure 1.)

Closely related to the Costa Rican *L. biolleyi* Bruner,[23] the present insect differs in the fastigium, which shows distinctly greater depression of its dorsal surface in distal portion, the decidedly impresso-punctate dorsum of the pronotum and the proportionately decidedly longer caudal limbs.

The genera *Silvitettix*, *Leuconotus* and *Compsacris* are closely related, belonging to the same group and following the order of linear arrangement here given. The ensiform antennae, much more strongly retreating face and other characters indicate that *Ochrotettix* Bruner belongs to a different group.

Type.—♂; Panama City, Panama. 1912. (J. Zetek.) [Hebard Collection, Type no. 910.]

Size medium, form slender; larger and more slender than *biolleyi*. Head with dorsal surface almost smooth, showing faint, irregularly transverse rugae, ascending to fastigium, the

[22] This interesting species is named in honor of Surgeon-General Wm. C. Gorgas, U. S. A., who successfully completed the stupendous task of eliminating from the Canal Zone diseases which, to that time, had made it one of the most dangerous regions in the American tropics.

[23] The type is in the author's collection.

dorsal surface of which is nearly horizontal. Fastigium[24] acute with apex rather sharply rounded, length greater than greatest width, lateral margins bluntly carinate; distal portion weakly impressed by a curved, transverse line; foveolae lateral, very short, not impressed. Face much as in *biolleyi;* almost smooth, strongly retreating; frontal costa moderately narrow, broadening somewhat in portion below antennae, sulcate to near fastigio-facial angle. Eyes moderately prominent, not quite as large as is normal in *Compsacris*. Antennae missing. Pronotum short; the very narrow disk defined in color, but faintly delimited by subobsolete lateral carinae, its surface heavily impresso-punctate and with a medio-longitudinal carina except in brief portion cephalad, caudal margin weakly obtuse-angulate with apex rounded; lateral lobes longer than deep, moderately impresso-punctate, this heavy in metazonal portion. Interspace between mesosternal lobes strongly transverse.[25] Tegmina as in *biolleyi*, much reduced, overlapping and covering about half of abdomen, the dorsal and lateral fields distinct, the apex bluntly rounded. Wings apparently vestigial. Supra-anal plate shield-shaped with outline very simple, proximad with brief lateral carinae which terminate at a weak transverse sulcus. Caudal femora very elongate, moderately expanded proximad; genicular lobes rounded as in *biolleyi*. Caudal tibiae with eleven[26] dorso-external spines.

Specimen much discolored. Brown, dorsal portion of head, disk of pronotum and dorsal surface of tegmina and a proximal annulus of caudal tibiae paler. Dorsal portion of pronotal lateral lobes, lateral surface of tegmina and genicular areas of caudal femora darker.

Length of body, 16.9; length of pronotum, 3.9; total pronotal width, 2.9; length of tegmen, 7.8; length of caudal femur, 11.3; width of caudal femur, 2.2 mm.

The type of this interesting species is unique.

Group *Scyllinae*

Scyllina cyanipes (Fabricius)

1775. *Gryllus cyanipes* Fabricius, Syst. Ent., p. 292. [America.]

We have recently assigned Stål's *peragrans* and Saussure's *gregaria* to synonymy under this species.[27]

[24] Much as in *biolleyi*, except that the distal impressed area is very weak and a faint, medio-longitudinal carina is indicated in that species.

[25] Moderately transverse in *biolleyi*.

[26] These number ten to eleven in the series of *biolleyi*.

[27] Trans. Amer. Ent. Soc., XLIX, p. 211, (1923).

Gatun, Canal Zone, Panama, 1914, (J. Zetek), 1 ♂, [Hebard Cln.].

Ancon, C. Z., Pan., 1914, (J. Zetek), 1 ♂, [Hebard Cln.]; XI, 16, 1913, (Hebard; beaten from short grass in open), 1 juv.

Taboga Island, Pan., II, 26, 1912, (A. Busck), 1 ♀.

La Chorrera, Pan., IV, 13 and V, 11, 1912, (A. Busck), 4 ♂.

David, Chiriqui, Pan., VIII, 10, 1922, (D. E. Harrower), 1 ♂, 2 ♀, [A. N. S. P.].

The extremes, showing the decided size variation in the present series, measure as follows, in millimeters:

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur	Width of caudal femur
La Chorrera	21.1	4.1	3.2	20.3	14.4	3.4
Gatun	26.1	4.8	3.7	23.9	16.7	4
♀						
David	28.2	5.5	4.6	26.2	19	4.6
Panama	27.8	5.8	4.8	28.2	20	4.9
Taboga Island[28]	35.3	6.3	5.1	33.7	23	5.3

This is almost certainly the species recorded by Giglio-Tos from Panama as his *Pseudostauronotus brunneri*, a species of the genus *Scyllina* found in south-central South America.

Oedipodinae

Heliastus venezuelae Saussure

1884. *H[eliastus] venezuelae* Saussure, Prodr. Oedipodarum, p. 213. [♂, ♀: Venezuela; Colombia; Panama.]

Gulf of San Blas, Panama, VII, 1922, (D. E. Harrower), 3 ♂, 1 juv. ♂.

Cristobal, Canal Zone, Pan., 1912, (J. Zetek), 1 ♀, [Hebard Cln.].

France Field, Cristobal, C. Z., Pan., VII, 7, 1920, (Hebard; very few on almost bare, level ground of aviation field), 1 ♀, 1 juv. ♂, 1 juv. ♀.

The San Blas individuals are very evenly colored, with vague but solid indications of dark, transverse tegminal bands. Those from Cristobal are heavily speckled with very irregular traces of dark, transverse tegminal bands. All have the ventro-caudal angle of the pronotal lateral lobes roundly produced, the wings

[28] This is much the largest female in the large series of *cyanipes* before us.

brilliantly tinged with grenadine pink proximad,[29] becoming clear hyaline distad, with hardly a trace of suffusion in the area where the wing band, if present, would occur.

Compared with a Mexican series of *H. sumichrasti* (Saussure) in the Academy Collection, we find the present insect to have the frontal costa more sulcate dorsad, the ventro-caudal production of the pronotal lateral lobes more evenly rounded and the wings less richly colored and lacking a band.

The species is also found in Costa Rica.. It has been recorded from Colon and Punta de Sabana by Giglio-Tos.

Paulininae

This subfamily name must be substituted for Coelopterninae, as used by Stål, since *Coelopterna* has been synonymized under *Paulinia*.

Paulinia acuminata (DeGeer)

1773. *Acridium acuminatum* DeGeer, Mém. l'Hist. Ins., III, p. 501, pl. 42, fig. 10. [Surinam.]

Gatun, Canal Zone, Panama, VI, 1915 and VIII, 6 to 22, 1916, (D. E. Harrower), 1 ♂, 1 ♀.

Rio Trinidad, Pan., III, 17 to VI, 4, 1912, (A. Busck), 8 ♂, 6 ♀.

La Chorrera, Pan., IV, 13 and V, 12, 1912, (A. Busck), 8 ♂, 5 ♀.

None of the striking color phases developed in this singular little semi-aquatic grasshopper are shown by the present series. The insect is widely distributed over tropical South America, but has not been reported from north of Panama, from which country it had been recorded from Lake Pita by Giglio-Tos.

Cyrtacanthacrinae

Group *Procolpiae*

Munatia biolleyi Carl

1916. *Munatia biolleyi* Carl, Rev. Suisse de Zool., XXIV, p. 504, pl. 2, fig. 11. [♂, ♀; Costa Rica.]

Bocas del Toro, Panama, VII, 1 to 10, 1908, (W. Robinson), 1 ♂.

This specimen is somewhat smaller than the described males or a Costa Rican male in the Academy Collection, agreeing in

[29] The wings proximad are tinged with exactly the same shade, in almost all of the series referred to *sumichrasti*, before us.

all other respects closely, except in having the pronotal crest slightly higher, its lateral outline being, in consequence, feebly convex instead of nearly straight. The dark marking of the pronotal lateral lobes is continued to the ventral margin, as in one of the originally described males.

Length of body, 40.3; length of pronotum, 12.5; caudal width of pronotal disk, 5.2; length of tegmen, 40.2; length of caudal femur, 23.4 mm.

This is one of the most striking of the very large grasshoppers found in Central America.

Procolpia inclarata (Walker)

1870. *Xiphocera inclarata* Walker, Cat. Dermapt. Saltat. British Mus., III, p. 523. [♂; Orizaba, [Vera Cruz, Mexico].]

1907. *Munatia inclarata* Bruner, Biol. Cent.-Amer., Orth., II, pl. III, figs. 1 and 1a.[30]

1907. *Procolpia emarginata* Bruner (not *Xiphicera emarginata* Serville, 1831), Biol. Cent.-Amer., Orth., II, p. 223. [♂, ♀: Atoyac, Vera Cruz, Mexico; Pozo Azul [de Pirrís], Costa Rica.]

Rio Trinidad, Panama, III, 22, 1912, (A. Busck), 1 juv. ♀; V, 4, 1911, (A. Busck), 1 ♀.

This striking insect may be distinguished from the closely allied Brazilian *P. emarginata* (Serville)[31] by the character of the lateral margins of the fastigium, which are less nodulose, the finer median emargination of the pronotum cephalad, the tegmina which are distinctly narrower distad and the decidedly weaker elevation of the median carina of the dorsal surface of the caudal femora in the genicular area. All Central American records of *emarginata* are undoubtedly based on material of the present species.

Group *Diedronoti*

Argiacris tricristata (Serville)

1839. *Xiphicera tricristata* Serville, Hist. Nat. Ins., Orth., p. 613. [♀, Colombia.]

1897. *E[laeochlora] caternaultii* Giglio-Tos (not of Feisthamel, 1837), Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, no. 311, p. 3. [♂, ♀, juv.; Punta di Sabana, Rio Lara, Tin-Tin and Lake Pita, Panama.]

[30] These figures are good, but the apex of the tegmen was evidently reconstructed by the artist. This apex is transversely weakly concave in the present species.

[31] Comparison is made with a Brazilian pair of *emarginata* in the Academy Collection.

We have recently discussed the synonymy of this handsome species,[32] which is known to occur in Panama and Colombia. At that time it was found that the Panamanian and Colombian species, which had generally been referred to *Elaeochlora* Stål, were properly members of the genus *Argiacris* Walker.

Bugaba, Panama, (W. Schaus), 2 ♂.

Rio Trinidad, Pan., V, 7, 1911, (A. Busck), 1 small juv.

Cabima, Pan., V, 17 to 25, 1911, (A. Busck), 5 small juv.

France Field, Cristobal, Canal Zone, Pan., VII, 7, 1920, (Hebard; all on one vine tangle), 3 juv.

Gatun, C. Z., Pan., VII, 12 to VIII, 5, 1916, (D E. Harrower; common in scrubby growth on forest edge), 7 ♂, 6 ♀, 2 juv.

Lion Hill, C. Z., Pan., VII, 26, 1907, (A. Busck), 2 ♂.

Corozal, C. Z., Pan., VI, 1911, (A. Busck), 1 small juv.

Diedronotus rosulentus (Stål)

1878. *T[ropidonotus] rosulentus* Stål, Bih. till K. Svenska Vet. Akad. Handl., v, no. 9, p. 19. [♂, ♀; Nova Granada (= Colombia).]

Panama, (H. E. Wetherill), 1 ♀, [A. N. S. P.].

Juan Mina Plantation, Pan., 1919, (Dietz and Zetek), 1 ♂, [Hebard Cln.].

Panama City, Pan., 1915, (J. Zetek), 1 ♀, [Hebard Cln].

David, Chiriqui, Pan., VIII, 10, 1922, (D. E. Harrower), 1 ♂, [A. N. S. P.].

The pair from Juan Mina and Panama have the pronotum of the normal elongate type, characteristic of the species. The male from David and the female from Panama City are distinctly less elongate, with pronotum shorter, the female with crest slightly higher. In these respects they show divergence toward the allied Costa Rican *D. centralis* Rehn, but are more slender with crest lower, vertex narrower and organs of flight decidedly more elongate than in that insect.

The species is known from Nicaragua to Colombia.

Colpolopha rehni Hebard

1923. *Colpolopha rehni* Hebard, Trans. Am. Ent. Soc., XLIX, p. 226. [♀: Carrillo, Costa Rica; Central America; Colombia.]

Obispo Station, Canal Zone, Panama, 1 ♀, [Mus. Comp. Zool.].

[32] Trans. Amer. Ent. Soc., XLIX, p. 219, (1923).

This species is well figured by Bruner in the Biologia Centrali-Americana, Orthcotera, Volume II, as *Colpolopha sinuata*.[33]

The measurements of the present female are: length of body (abdomen retracted), 48; length of pronotum, 22.3; length of pronotal metazona, 13.1; height of largest tooth on emargination of pronotal crest caudad, .4; length of tegmen, 26.5; length of caudal femur, 26.3 mm.

Group *Taeniopodae*

Taeniopoda reticulata (Fabricius).

1781. [*Gryllus*] *reticulatus* Fabricus, Spec. Ins., I, p. 362. ["Bengal" (in error).]

Darien, Panama, 1914, (from J. Zetek), 1 ♀, [Hebard Collection.].

This specimen agrees closely with a female from Limón, Costa Rica, in the author's collection, differing only in the tegmina and wings showing somewhat greater reduction. The genus is peculiar to North America, *reticulata* having the southernmost distribution and being known only from four specimens.

Group *Chromacres*

Chromacris psittacus (Gerstaecker) (Plate VII, figure 2.)

1873. *Romalea psittacus* Gerstaecker, Ent. Zeit. Stettin, XXXIV, p. 185. [♂, ♀; Bogotá, (indicating merely Colombia).]

Porto Bello, Panama, II, 20 to III, 2, 1911, (A. Busck), 10 very small juv.; IV, 17, 1912, (A. Busck), 7 medium sized juv.

Gatun, Canal Zone, Pan., VI, 1915, VII, 12 to VIII, 22, 1916, (D. E. Harrower; in scrubby growth on forest edge), 12 ♂, 7 ♀.

Bocas del Toro, Pan., VII, 1 to 10, 1908, (W. Robinson), 1 ♂, 2 ♀.

Rio Trinidad, Pan., V, 1, 1911 and VI, 6, 1912, (A. Busck), 1 ♂, 2 ♀.

Alhajuela, Pan., IV, 5 and 6, 1911, (A. Busck), 8 very small juv.

Cabima, Pan., V, 18 to 28, 1911, (A. Busck), 9 ♂, 4 ♀. 8 large juv.

[33] Plate II, figures 25 and 25a.

All of the present adults have the wings rich orange chrome marked with black. They agree closely with the Colombian series recently recorded by us.

The Panamanian material recorded as *C. trogon* (Gerstaecker), by Giglio-Tos, probably represents this species, which is known from Nicaragua to Colombia.

Group *Tropidacres*

Lophacris gloriosa new species (Plate VIII, figure 1.)

This magnificent insect[34] is much the largest species of the present genus and may be readily recognized by the wonderfully bicolored radiate field of the wings. As yet it is known only from in or near the Canal Zone, all previous records of the genus from other portions of tropical American being referable to other species, of which three are represented in the series of twenty-six specimens of *Lophacris* before us. All of the other species have the radiate field of the wings evenly pink, more reddish in some, more purplish in others.

The literature for this genus is much confused. Scarcity of material in collections and the resultant inability to make proper comparisons has apparently caused this situation, as the species are actually readily distinguishable.

Type.— ♀ ; Paraiso, Canal Zone, Panama. April, 1911. (A. Busck.) [United States National Museum.]

Size very large for this genus of very large grasshoppers, form robust. Frontal costa and face thickly impresso-punctate, this heavier than in *L. olfersii* (Burmeister),[35] ventral portion of genae much less strongly so, occiput with a few very small impressed punctae. Pronotum heavily but evenly tuberculate, this more decided than in *olfersii*. Crest much as in that species; with five lobes, the last on metazona followed by several large teeth, which decrease in size caudad, so that at the caudal apex of the pronotum the crest has subsided into a feeble mediolongitudinal carina. Shoulders on metazona prominent but rounded, caudal margin of disk with lateral portions very feebly concave, then as feebly convex to the apex, forming an angle

[34] Bruner's Panamanian record of *Titanacris velasquezii* is based on a specimen of *Lophacris gloriosa*. The specimen which he figured, as well as others, labelled simply "Panama," is in the United States National Museum.

[35] Comparison is made with eight tropical North and South American specimens of this species, in the Philadelphia Collections. As *olfersii* is found in the tropics of both North and South America, the species should eventually be found in Panama.

slightly less than a right angle and consequently distinctly broader than in *olfersii*. Prosternal spine erect, stout, elongate, with apex acute. Tegmina and wings fully developed and very ample. Ovipositor valves large with margins not denticulate, their apices well curved. Caudal femora elongate, enlarging weakly proximad.

Allotype.—♂; Alhajuela, Panama. April 10, 1911. (A. Busck.) [United States National Museum.]

Much smaller and not as robust as female, agreeing closely in ambisexual characters. Caudal margin of pronotum resultantly slightly more produced with angle considerably narrower, though not as narrow as in this sex of *olfersii*. Genitalia very distinctive, but apparently showing generic rather than specific characters. The supra-anal plate with deflexed sides separated from median portion by longitudinal carinae, the lateral vertical plates acutely produced dorso-distad, the small styliform cerci and the subgenital plate produced to an acute apex with sides compressed, are all features similarly developed in *olfersii*.

General coloration apple green, in some examples apparently faded and much more yellowish; in the type alone ferruginous, showing that two color phases occur. Antennae dark brown, shading to the body coloration proximad. Crest of pronotum edged with carnelian red, the limbs weakly suffused with this color, which is particularly evident on dorsal surface of caudal femora. Caudal femora externally with two rows of buffy white spots, which fuse in distal portion and a dorso-internal row of buffy white dots, the genicular areas with a crescent of chocolate. Wings with distal portion of anterior field and distal portion of adjacent section of radiate field transparent tinged with yellowish green, remaining proximal portion of anterior field and radiate field translucent weak carmine, gradually changing in the latter field to hyacinth purple, so that the caudal portion of that field is solidly of that color.

This insect is one of the largest and most strikingly and beautifully colored of the American grasshoppers.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Alhajuela, *allotype* . .	63	14.9	10	71.3	15	31.4
Alhajuela, *paratype* . .	69.7	15.8	10.2	73	14.7	——
Tabernilla, *paratype*. .	69.8	15	10	72.3	14.7	32.7
♀						
Paraiso, *type*	104	23.6	15.8	106.4	22.8	49
Paraiso, *paratype*	102.3	23.2	15	105	22.5	45.2
Porto Bello, *paratype*.	105.5	23.3	15.8	100.7	——	——
Panama, *paratype*. . . .	109.1	24.6	15.4	109	23.8	47.6

The lobe on the metazona is often bidentate and in one specimen occurs an additional smaller lobe, making a total of six instead of five. Otherwise the series shows little variation.

Specimens Examined: 8; 3 males and 5 females.

Panama, 1910, (Flora W. Patterson), 1 ♀, *paratype*, [U. S. N. M.].

Porto Bello, Pan., IV, 1912, (A. Busck), 1 ♀, *paratype*.

Alhajuela, Pan., IV, 10 and 24, 1911, (A. Busck), 2 ♂, *allotype* and *paratype*.

Paraiso, Canal Zone, Pan., IV, 1911, (A. Busck), 2 ♀, *type* and *paratype*.

Culebra, C. Z., Pan., I, 15, 1908, (F. A. Stoddard; on rubber plant), 1 ♀, *paratype*.

Tabernilla, C. Z., Pan., (A. Busck), 1 ♂, *paratype*.

Tropidacris latreillei (Perty) (Plate VII, figure 3.)

1830. *Acrydium latreillei* Perty, in Spix and Martius, Delect. Animal. Artic. pl. 123, pl. XXIV, fig. 4. [Amazon River.]

Porto Bello, Pan., III, 2, 1911 and IV, 16, 1912, (A. Busck), 4 ♂, 8 ♀.

Colon, Pan., 1913, (J. Zetek), 2 juv., [Hebard Cln.].

Gatun, Canal Zone, Pan., VI, 1915, (D. E. Harrower), 1 juv.

France Field, Cristobal, C. Z., Pan., VII, 7, 1920, (Hebard), 4 ♀.

Taboga Island, Pan., 1915, 1 ♂, [U. S. N. M.].

Pinogana, Darien, Panama, XII, 1915, (Muñoz), 2 ♀, Hebard Cln.].

The species has been recorded as *Tropidacris dux* (Thunberg) from Punta de Sabana and the Rio Cianati by Giglio-Tos.

The vinaceous-rufous wings, marked and bordered with blackish brown, distinguish this huge grasshopper from any other species found in the Canal Zone.

We have figured the remarkably banded immature condition of this insect.

We first noticed an individual of this enormous grasshopper perched near the highest twig of a bush, which projected well above the surrounding tangle of green brush and vines, growing in a marshy spot. Closer examination revealed five, all but one of which were easily captured, though some ten feet from the ground, as when approached closely they merely shrank away from the hand or attempted to climb slowly away. One individual, however, suddenly took flight and, though appearing ponderous in the air, quickly disappeared in the distance.

Group *Taeniophorae*

Nautia flavosignata Stål

1878. *N[autia] flavosignata* Stål, Bih. till K. Svenska Vet.-Akad. Handl., v, no. 4, p. 87. [♀, Panama.]

Porto Bello, Panama, II, 15, 1911, (A. Busck), 1 very small juv.

Gatun, Canal Zone, Pan., VII, 17 to 31, 1916, (D. E. Harrower; in scrubby growth on edge of forest), 2 ♀, 1 very small juv.

From comparison with the types of the Costa Rican *N. petasata* Rehn[36] and *N. conspersipes* Bruner[37] we find that these species are extremely close; *conspersipes* is nearest *flavosignata*, differing only in having the fastigium, tegmina and caudal limbs slightly more elongate and the tubercles of the caudal femora blackish instead of being of the general light green coloration. The species *petasata* has the fastigium, tegmina and caudal limbs decidedly more elongate, the caudal margin of the pronotal disk more strongly convex, and the tubercles of the caudal femora dark, the latter feature as in *conspersipes*. The antennae in *flavosignata* are moderately ensiform.

The genus includes only these three species, two others which have been assigned to it by Bruner being members of the very distinct genus *Opthalmolampis*. It is evident that *Nautia* forms a link between the genera *Opthalmolampis* and *Trybliophorus*.

The measurements of the present females are; length of body, 22.3 and 25; length of antenna, 17.7 and 18.5; length of pronotum, 6.8 and 6; length of tegmen, 7.7 and 9; length of caudal femur, 14.1 and 13.8; length of caudal tarsus, 8 and 7.9 mm.

Taeniophora panamae new species (Plate VI, figures 11, 12 and 13.)

This interesting little insect agrees closely with the Colombian *T. dentipes* Stål[38] in the limb armament, general character of the male genitalia and coloration of the limbs; the caudal femora, however, have their genicular areas pale yellowish. The color pattern suggests the Colombian *T. chocoensis* Hebard, known only from the female sex, but the pale antennae, hay's russet

[36] Hebard Collection, Type no. 303.

[37] Hebard Collection, Type no. 302.

[38] Bruner has stated, "This insect (*dentipes*) is certain to be found in Panama." We think it very unlikely.

cephalic and median limbs and coral red caudal tibiae and tarsi readily distinguish that insect.

Type.—♂; Porto Bello, Panama. February 27, 1911. (A. Busck.) [United States National Museum.]

Size and form much as in the genotype, *dentipes*. Head with interocular space exceedingly narrow; vertex very small, with a subobsolete, linear, medio-longitudinal sulcation, weakly declivent and abruptly truncate distad but there rounding smoothly into the frontal costa, which between the antennae is briefly produced, its flattened surface one and two-thirds times the width of a proximal antennal joint. Ventral margins of genae heavily impresso-punctate, mesonotum moderately impresso-punctate, other portions of head and pronotum and pleura with scattered impressed punctae. Width of prominent eye distinctly over twice the length of the decided infra-ocular sulcus. Pronotum very short, slightly narrowest mesad, transverse sulci very deep; cephalic margin narrowly embracing occiput and with a shallow, broadly rounded median emargination, caudal margin very broadly convex though showing a trace of angulation. Prosternum weakly convex, with a very small, erect, conical projection meso-caudad. Tegmina and wings reduced, covering about proximal half of abdomen, failing to reach median point of caudal femora. Tegmina with costal and sutural margins evenly and weakly converging to the broadly rounded apex. Wings cycloidal. Supra-anal plate concave on each side, roughly shield-shaped, notched on each side opposite the inbent apices of the cerci. Cerci moderately stout, directed dorsad, expanding distad and there obliquely truncate, due to the more decided production of the caudal portion, there with distal portion strongly bent inward, forming a horizontal and nearly semicircular lamella, the base of which occupies the distal two-thirds of the shaft's truncation and forming a brief cleft with it in cephalic portion. Subgenital plate small and rounded, produced dorsad in a less strongly chitinous bilobation.[39] Cephalic femora with a large tooth meso-dorsad, directed distad; median femora with a homologous but subobsolete projection. Caudal femora robust, with impressed, broadly and bluntly V-shaped sulci of external pagina well defined; the carinae smooth, except the dorso-median which bears a few feeble serrulations; dorsal and ventro-external surfaces shallowly impresso-punctate. Caudal tibiae with nine (including the distal) dorso-external spines. Caudal tarsus slightly over half as long as caudal tibia, first and second joints subequal in length, third decidedly longer than second.

[39] Apparently much as described for *dentipes*.

Head chestnut-brown except occiput which is darker, with the following markings of ochraceous-buff; dorsal surface of vertex, a row of flecks along eyes on each side of occiput, a post-ocular fleck ventrad, a broad band from antennal sockets to caudal margin of genae near ventral margin and four flecks on face. Antennae black, becoming greenish brown proximad. Pronotum blackish chestnut brown with a band of ochraceous-buff on each side of disk, interrupted by the transverse sulci, and a broader band of the same color on each side mesad in the lateral lobes, continued as large flecks on the pleura, which are blackish brown dorsad and jade green ventrad. Tegmina chestnut brown, with a faint buffy line separating the dorsal and lateral fields and a broad band of blackish chestnut brown along costal margin. Ventral surface greenish, becoming greenish yellow on abdomen. Coxae and cephalic and median limbs jade green. Caudal femora jade green, with internal pagina and greater portion of external pagina black and entire genicular areas cinnamon-buff with crescent cinnamon. Caudal tibiae with immediate base cinnamon-buff, then briefly jade green, the remaining two-thirds heavily suffused with blackish brown, caudal tarsi clay color.

Length of body, 14; length of pronotum, 2.9; length of tegmen, 5.8; width of tegmen (approximately), 2.2; length of caudal femur, 9.4; width of caudal femur, 2.7 mm.

The type of this handsome little species is unique.

Taeniophora chocoensis Hebard

1923. *Taeniophora chocoensis* Hebard, Trans. Amer. Ent. Soc., XLIX, p. 234, pl. x, fig. 5. [♀ and juv.; Boca Murindo and Andagoya, Chocó, Colombia.]

Pinogana, Darien, Panama, XII, 1915, (Muñoz), 1 ♀, [Hebard Cln.].

This specimen differs from the type in having the four longitudinal bands of naples yellow broad and solid, while the organs of flight are slightly shorter.

The species of the genus are not known from sufficient material to determine whether they are constant or somewhat plastic in color pattern. In consequence, we do not believe it advisable to attribute racial or higher significance, to the differences noted.

Taeniophora femorata Bruner

1907. *Taeniophora femorata* Bruner, Biol. Cent.-Amer., Orth., II, p. 245. [♂, ♀; Pozo Azul [de Pirrís], Costa Rica.]

Chiriqui, Panama, 1 ♂, [Hebard Cln.].

This specimen agrees fully with the type in the author's collection, no. 304.

Taeniophora megacephala Bruner

1907. *Taeniophora megacephala* Bruner, Biol. Cent.-Amer., Orth., II, p. 246. [♀, Panama.]

The unique type from the Scudder Collection, at the Museum of Comparative Zoology, is before us, a specimen which has clearly lost most of the natural color, having been dried after immersion in some liquid preservative.

Pale pronotal vittae are indicated and in life were probably much like those developed in *T. femorata* Bruner. Compared with the allotype of that species the present female is seen to differ in the much larger head and smaller caudal limbs, in proportion to the body bulk. The vertex (.6 mm. in width) is wider than in any other species of *Taeniophora* known to us. The caudal femora are not slender, as stated by Bruner, though more slender than in the other forms of the genus.

Group *Mezentiae*

Rhicnoderma magnificum new species (Plate VIII, figure 2.)

This species may at a glance be separated from the previously known forms of *Rhicnoderma* by its very brilliant and beautiful markings, in which orange, green and black are conspicuous.

Generally close structural agreement with the Costa Rican *R. humile* Rehn[40] is found, the present insect being, however, decidedly more elongate, with cephalic margin of pronotum showing more decided lateral projection of the median emargination, the femora all decidedly less lamellate and proportionately longer and the ventral surface scarcely hirsute.

The Panamanian genotype, *R. olivaceum* Gerstaecker, is structurally distinguished from these species in having a distinct medio-longitudinal pronotal carina between the first and second and between the third and fourth transverse sulci.

Type.—♂; Gatun, Canal Zone, Panama. August 6 to 22, 1916. (D. E. Harrower; scrubby growth on edge of forest.) [Hebard Collection, Type no. 913.]

[40] The type in the Academy Collection is before us, as well as an unrecorded Costa Rican series.

Size moderately large, form tapering caudad from the large truncate head, surface of mesosternum and metasternum moderately concave. Surface of head evenly and finely rugulose-impresso-punctate, this slightly weaker on pronotum and decidedly weaker on abdomen, which distad gradually becomes smooth. Caudal tibiae and tarsi moderately hirsute, this decided proximad on the dorsal surface of the former, everywhere very much less than in *humile*. Head transversely flattened, slightly deeper than broad, widest across the eyes. Interocular space about three-fifths as wide as the large eye (nearly equal to the width of the smaller eye in this sex of *humile*). Fastigium nearly vertical and juncture with frontal costa scarcely perceptible, between the eyes a rectangular area is bounded by fine lateral and a transverse carina ventrad, the former then run to the eye and back along its margin dorsad, forming sharp angles on each side of the fastigium; infra-ocular carina and sulcus decided, the latter about one-third as long as the eye. Pronotum evenly cylindrical, short; cephalic margin with an obtuse-angulate median emargination produced in rounded projections on each side; caudal margin transverse; median carina obsolete; three decided transverse sulci present, but with another distinct sulcus near the cephalic margin on each side, the first sulcus is only in the discal portion and terminates on each side in a distinct impression, while there is a smaller impression, more lateral in position, between the second and third sulci. Mesonotum with an angular impression meso-laterad on each side. Tegmina and wings absent. Prosternum produced in a lobe, the cephalic face of which is flattened and higher than wide, terminating in produced, rounded lateral angles. Abdomen with a very feeble, medio-longitudinal, dorsal carina. Supra-anal plate elongate-trigonal, with a transverse median sulcus. Cerci simple, styliform. Subgenital plate curving to meet apex of supra-anal plate, pinched, apex wrinkled and appearing subchitinous. Cephalic femora moderately inflated, horizontally flattened, feebly bowed. Median femora moderately inflated, vertically flattened, very feebly bowed. Caudal femora moderately heavy, widest just before median portion, somewhat flattened vertically, but by no means almost lamellate, as in *humile;* dorsal and ventral margins decidedly serrulate, other margins finely and weakly so, the dorsal carina produced in a small, slightly elevated tooth at its genicular extremity; ventral margin of genicular lobes rather strongly angulato-convex. Caudal tibiae with ventral surface flattened and with an external carina, armed with eight dorso-external and nine dorso-internal stout spines (including the apical in both cases). Caudal metatarsus slightly longer than second joint, equal in length to third joint. Coloration of great diagnostic importance.

Head with occiput, vertex, face and genae citron green, marked with black as follows: a large, triangular median area on occiput, with a small triangle at its apex joining it with the eyes, the carinae between the antennae and the eyes and a broad postocular band. Mouthparts liver brown and black, with a fleck of citron yellow on each mandible. Antennae orange-cinnamon. Pronotum apricot orange except as follows; narrow metazona and small adjacent area ventrad on lateral lobes citron green, cephalic margin broadly black but only in area caudad of each eye, ventral margin of lateral lobes narrowly black, this becoming wide caudad, caudal margin very narrowly black. Mesonotum and pleura (except their ventral portion which is black) apricot orange. Metanotum and pleura black, the former with two large, rounded areas of citron green tinged with orange laterad and a fine medio-longitudinal line of the same. Abdomen black with the same medio-longitudinal line and a slightly heavier line on each side of apricot orange. Ventral surface of body shining black. Cephalic and median limbs ivy green. Caudal femora ivy green, with ventral surface and genicular portions black. Caudal tibiae black, with external surface finely lined and all but apices of spurs dull apricot buff. Caudal tarsi dull apricot buff.

The measurements of the type are given first. ♂. Length of body, 40.7 and 30.8; width across eyes, 8.2 and 6.8; length of pronotum, 6.1 and 4.8; greatest total width of pronotum, 7.9 and 6; length of exposed portion of mesonotum and metanotum, 7 and 5.1; length of caudal femur, 20.9 and 16.3; greatest width of caudal femur (meso-proximad), 4.7 and 3.8; length of caudal tarsi, 10.8 and 8.8 mm.

A single male paratype is before us, bearing the same data except that it was taken July 17 to 23, 1916. Though identical in structure and the very complex color pattern, and apparently adult, it shows a size difference seldom found in the same species at the same locality.

Mezentia gibbera Stål

1878. *M[ezentia] gibbera* Stål, Bih. till K. Svenska Vet.-Akad. Handl., v, no. 4, p. 88. [♂, Panama.]

Porto Bello, Panama, III, 25, 1911, (in stomach of a bird), 1 ♂, [U. S. N. M.].

Stål has rightly stated "Species maxime singularis." The specimen before us is greatly discolored, but the caudal tibiae are seen to be black, with brief proximal portion and entire external face pale.

The general form of the head and limbs shows nearest resemblance to *Rhicnoderma*. From that genus it may be readily separated by the bidentate apex of the strongly declivent but not vertical fastigium, the gibbous and tuberculate caudal half of the pronotum with caudal margin weakly produced, the presence of tegmina and wings (though considerably reduced), the nodiform but not bidentulate prosternum, the highly specialized male genitalia and much fewer, heavier spines of the caudal tibiae.

The following features of importance were originally not clearly presented. Apex of very strongly declivent fastigium briefly produced above and between the antennae in two blunt nodes, the cephalic surface of which ventrad forms the flattened but weakly concave, briefly produced portion of the frontal costa Lateral carinae of face decided, but infra-ocular sulci almost obsolete. Interocular space as wide as the large eye, the latter much less nearly vertical than is usual in the subfamily. Limbs resembling in many respects the type found in *Rhicnoderma*. Cephalic femora stout, horizontally thickened and weakly bowed, hirsute. Median femora vertically decidedly lamellate, ventral surface strongly hirsute. Caudal femora heavy, proportionately heavier than in *Rhicnoderma magnificum*, here described, but of the same general contour, dorsal margin decidedly serrulate, other margins finely and weakly so, the dorsal carina without an apical tooth; ventral margin of genicular lobes angulato-convex, but not as decidedly as in *Rhicnoderma magnificum*. Caudal tibiae with ventral surface as in that species but very strongly hirsute, with four dorso-external and six dorso-internal, unusually heavy, incurved spines (including the apical in both cases). Caudal metatarsus longer than second joint, equal in length to third. The tergite preceding the supra-anal plate has its distal margin laterad, to beneath the cerci, black and lamellate, this breaking into a series of black teeth above the supra-anal plate, of which five are large and the lateral pair bidentate. The supra-anal plate has a meso-proximal transverse sulcus, preceded by a black carina which bears a black tooth on each side and between these two smaller black teeth, the larger lateral teeth are each preceded by two small, but stout, black

teeth; the apex of this plate is slenderly produced. The distinctive cerci are reflexed.

As the length alone was given for the type, we add the following measurements, estimated in several cases as the specimen before us is in very poor condition, having been devoured by a bird. Length of body,[41] 32; width across eyes, 7.8; length of pronotum, 6.8; greatest total width of pronotum, 6.8; length of tegmen, 13.3; greatest width of tegmen, 3.3; length of caudal femur, 20.7; greatest width of caudal femur (meso-proximal), 4.9; length of caudal tarsi, 10.8 mm.

Group *Leguae*

Legua crenulata (Stoll)

1813. [*Gryllus Locusta*] *crenulata* Stoll, Natuur. Afbeeld. Beschr. Spoken etc., Trek.-Springhaanen, p. 14, Register p. 12, pl. VIb, fig. 18. [♀ (nec ♂), Africa.[42]]

We concur with Kirby in finding incorrect Bruner's assignment of the South American genus *Prorachthes* Gerstaecker to synonymy under *Legua* Walker.

In *Legua* the vertex and frontal costa form an elongate, conical projection, with sides flattened but not squeezed-in and with antennae situated nearly at its apex. The antennae are weakly ensiform, with sides of slightly expanded first joints moderately convex. The prosternum is flattened bilobate. The horizontal fastigium is not separated from the vertex by any distinct sulcus. The pronotum is only slightly shorter than the dorsal surface of the head, with caudal margin bluntly obtuse-angulate. The mesosternal lobes are not attingent, being separated by an interval longer than broad in both sexes.[43] The dorso-external margins of the caudal tibiae bear a distal spine. The ovipositor valves are of a normal type, with sharp apices curved dorsad and ventrad.

The shape of the head and position of the antennae show nearest agreement with the genus *Episcopotettix* Rehn and other genera placed near or in the Group Copiocerae, to which it would appear possible that *Prorachthes* may belong. In those genera,

[41] Taken as if straightened out, the male apparently carrying the abdomen with apex strongly recurved.

[42] In error. Probably from Central America.

[43] This is given as attingent for *Prorachthes* by Giglio-Tos and has apparently been used by Bruner in placing *Legua* in his key.

however, the fastigium is separated from the vertex by a distinct sulcus, the antennae are narrowly ensiform with proximal joints flattened, the pronotum is much shorter than the dorsal surface of the head with caudal margin convex, the mesosternal lobes are attingent, the caudal tibiae have their dorso-external margin lacking a distal spine,[44] while the ovipositor valves are not of a normal type, having simple, slender, finger-like apices.

The Group Leptysmae, though superficially agreeing in the elongate form, shows more and even greater differences.

As a result, we consider the Leguae a highly aberrant group, developed along very different lines, but probably, in linear arrangement, best placed after the Group Mezentiae. Resemblance to *Rhicnoderma* is shown in the development of the posternum, armament of the caudal tibiae and in the general character of the genitalia in both sexes.

Panama, 1 ♂, [Uhler Cln. in Museum of Comparative Zoology].

Porto Bello, Pan., VII, 2, 1911, (A. Busck; on palm), 1 ♀.

Not only is the female very much larger and more robust than the male, but the head shows differences in having the longitudinal sulcus of the fastigium weaker, the interocular space broader and the total dorsal length less, instead of considerably greater, than that of the pronotum. The female further shows unusual sexual differentiation in the distinctive tegminal form, the tegmina of the male being in proportion decidedly narrower and lacking the distal obliquity of the costal margin.

The general green coloration, with wings bittersweet orange and caudal tibiae and tarsi blackish purple, readily distinguishes this distinctive insect from any of the other grasshoppers known to occur in Central America.

Length of body, ♂, 45; ♀, 79.7: total dorsal exposed length of head, ♂, 8.8; ♀, 14.7: length of fastigium, ♂, 4 2; ♀, 6.9: interocular width, ♂, .9; ♀, 2.6: length of pronotum, ♂, 6.3; ♀, 13: length of tegmen, ♂, 36.3; ♀, 68.4: greatest tegminal width, ♂, 3.2; ♀, 10: length of caudal femur, ♂, 17; ♀, 30.1 mm.

The fact that so large and brilliantly colored an insect is very rare in collections suggests that the species is one of the scarcest of Central American grasshoppers.

[44] This feature has not been given for *Prorachthes*.

Group *Leptysmae*

Leptysma insularis (Bruner)

1906. *Cylindrotettix insularis* Bruner, Journ. New York Ent. Soc., XIV, p. 153. [♀, Island of Trinidad.]

We have recently placed *Cylindrotettix* Bruner under *Leptysma* and that author's *C. herbaceus* as a synonym of *insularis*.[45] The insect is now known from Honduras, Costa Rica, Panama, Colombia and Trinidad.

Corozal, Canal Zone, Panama, XI, 17, 1913, (Hebard; beaten from low vegetation on edge of forest), 2 juv.

Individuals of this genus are rarely received from Central America.

Opshomala[46] **cylindrodes** (Stål) (Plate VI, figures 14 and 15.)

1860. *Opsomala cylindrodes* Stål, Kongl. Svenska Freg. Eugenie's Resa, Zool., I, p. 325. [♀; Rio de Janeiro, [Brazil].]

The type of Bruner's *minor* [47] when compared with Brazilian males, apparently correctly recorded as *cylindrodes* by Rehn, is found to represent a distinct though very closely related species.

Porto Bello, Panama, (A. H. Jennings), 1 ♀.

Rio Trinidad, Pan., V, 9, 1911, (A. Busck), 1 ♀.

Panama City, Pan., 1912, (J. Zetek), 1 ♂, [Hebard Cln.].

Material of *cylindrodes* is before us from "Central America;" [48] the Panamanian localities listed above; Cariaquito and Buelta Triste, Venezuela; Paramaribo, Dutch Guiana; Pará, Igarapé-Assú and Obidos in the State of Pará and Porto Alegre, Rio Grande do Sul, Brazil.

Males are readily identified by the genitalia, here figured. Females are much more difficult and in some cases can not be determined without the presence of material of the opposite sex.

[45] Trans. Amer. Ent. Soc., XLIX, p. 243, (1923).

[46] Under *Opshomala* have now been placed *Stenacris*, *Arnilia* and *Chrostheipus*, as well as the emendations *Opsomala* and *Opomala*.

[47] A male from San José, Guatemala; Hebard Collection, Type no. 311. The pair recorded by Bruner as *minor*, from Medellin, Vera Cruz, Mexico, represents instead *O. marshalli* (Bruner), so that his description of the female in the Biologia is actually based on material of that species.

[48] This male, probably from Panama, was recorded by Bruner, in the Biologia Centrali-Americana, as *minor*.

Opshomala goethalsi[49] new species (Plate VI, figures 16 and 17.)

This handsome species is nearest *O. chocoensis* Hebard, recently described from the Colombian Chocó.[50] It differs in the following features of the male subgenital plate. The two scythe-like lamellae are horizontal throughout, with apices briefly separated. Between the apices of these, surmounting a well-raised neck, is a usually[51] larger, delicate, horizontal, flat, elongate oval plate, its caudal extremity broadest and above the apices of the lamellae.[52]

Type.—♂; France Field, Cristobal, Canal Zone, Panama. August 18, 1920. (M. Hebard.) [Hebard Collection, Type no. 914.]

Differs very slightly from *chocoensis*, except in genitalic features. Size medium, form slender, slightly more robust than in *O. cylindrodes* (Stål). Interocular space very slightly over half as wide as first antennal joint. Fastigium as long as proximal width including the comparatively prominent lateral ocelli, its surface medio-longitudinally obscurely sub-sulcate. Frontal costa decidedly sulcate to opposite lateral ocelli. Pronotum cylindrical, with weak shoulders indicated caudad; its surface finely impresso-punctate, this very weak mesad. Tegmina and wings fully developed, extending decidedly beyond caudal femora, the former with apices acute. Prosternal spine cylindrical, with apex rounded. Supra-anal plate with lateral margins of proximal portion thickened and raised, the plate then suddenly very strongly narrowed, so that the distal portion projects as a slender finger, lying in a groove between subchitinous lateral plates. Cerci directed ventrad, then suddenly bent dorsad, the slender distal portion erect, with aciculate apex inclined slightly cephalad. Subgenital plate highly specialized and differing from that of *chocoensis* as described above. Caudal tibiae moderately enlarged distad, with dorsal margins there finely lamellate, external margin armed with small, delicate spines.

Allotype.— ♀; same data as type. [Hebard Collection.]

Differs from male as follows. Size larger, form more robust. Interocular space three-quarters as wide as first antennal joint.

[49] Named in honor of George Washington Goethals, Chief Engineer of the Panama Canal, 1907 to 1914, and appointed the latter year Civil Governor of the Canal Zone.

[50] Trans. Amer. Ent. Soc., XLIX, p. 247, (1923).

[51] In the two males from Paraiso, Panama and Surubres, Costa Rica, this plate is little larger than is normal for *chocoensis*.

[52] The contour of this caudal extremity varies from evenly rounded to feebly bilobate.

Fastigium broader, slightly shorter than proximal width, its sulcation more distinct. Antennae less elongate. Subgenital plate U-emarginate on each side of the acute, produced median portion. Ovipositor valves very short, heavy and strongly dentate.

General coloration courge green, shading to dark brown on genae, lateral lobes of pronotum and pleura above a broad, whitish band. Antennae greenish brown. Tegmina hyaline except in proximal portion. Wings hyaline, colorless, except costal margin and in proximal portion where they are faintly tinged with bluish. Ventral surface and femora olive ocher, the caudal femora often more greenish distad, all tibiae more greenish. Abdomen olive ocher with dorsal surface purplish brown. Caudal tibiae pale greenish yellow, caudal tarsi often suffused with reddish brown.

In the females the dark suffusion above the pale lateral bands is often much weaker. The pronotum sometimes shows a suffused brownish medio-longitudinal band in the males, a weaker brownish suffusion often covering the entire dorsum of the pronotum in females.

Such color differences as appear to exist between the present series and that of *chocoensis* are all probably of no diagnostic value, the specimens of that insect being all more intensive in coloration than those of *goethalsi* before us.

Measurements (in millimeters)

♂	Length of body	Width across eyes	Length of pronotum	Length of tegmen	Length of caudal femur
France Field, Panama, *type* ...	29.8	4	4.9	24	15
Limon Plantation, Panama, *paratype*.....	28.7	3.8	4.8	23	14.2
Limon Plantation, Panama, *paratype*.....	26.7	3.8	4.8	22.8	13.8
Paraiso, Panama, *paratype*....	27.8	3.8	4.8	23	14
Surubres, Costa Rica.....	25.3	3.4	4.3	20.9	12.9
♀					
France Field, Panama, *allotype*.....	37	4.7	6	28.2	17.9
Paris Field, Panama, *paratype*.	32.5	4.4	5.7	27.3	16.8
Paris Field, Panama, *paratype* .	37.8	4.9	6.1	30.7	18.9

Decided size variation appears to occur in all the species of this genus.

Specimens Examined: 12; 5 males and 7 females.

Surubres, near San Mateo, Costa Rica, 250 meters, II, 1905, (P. Biolley), 1 ♂,[53] [A. N. S. P.].

France Field, Cristobal, Canal Zone, Panama, VII, 7 and VIII, 18, 1920, (Hebard; occasional in vine tangles on edge of heavy, low, swamp forest), 1 ♂, 7 ♀, *type, allotype, paratypes.*

Paraiso, C. Z., Pan., III, 25, 1911, (A. Busck), 1 ♂, *paratype.*

Limon Plantation, Rio Chagres, Pan., VII, 14, 1918, (Dietz and Zetek; sweeping around corn field), 2 ♂, *paratypes,* [U. S. N. M.].

Group *Stenopolae*

Inusia chipmani Bruner

1906. *Inusia chipmani* Bruner, Journ. New York Ent. Soc., XIV, p. 154. [♂, ♀; Island of Trinidad.]

1908. *Inusia nana* Bruner, Biol. Cent.-Amer., Orth., II, p. 260. [♂, ♀; Limón[54] and Pozo Azul [de Pirrís], Costa Rica.]

1908. *Inusia bicolor* Bruner, Biol. Cent.-Amer., Orth., II, p. 260. [♂, ♀: Tampico, Tamaulipas; Venta de Peregrino, Guerrero; Teapa, Tabasco, and Valladolid, Yucatan, Mexico: Chacoj and Los Amates, Guatemala;[55] San Mateo, Costa Rica: Central America.]

Comparison of the types of *nana* and *bicolor* with a topotypic series of *chipmani* proves that no diagnostic features exist worthy of specific or racial recognition and the above synonymy is consequently indicated.

France Field, Cristobal, Canal Zone, Panama, VII, 7 and VIII, 18, 1920, (Hebard; few in vine tangles on edge of low, heavy, swamp forest), 2 ♂, 2 ♀.

Gatun, C. Z., Pan., VII, 12 to 22, 1916, (D. E. Harrower), 1 ♀, 1 juv.

Guamina, Rio Chagres, Pan., III, 5, 1922, (G. H. H. Tate), 1 ♀.

Ancon, C. Z., Pan., II, 11, 1920, (J. Zetek), 1 juv., [Hebard Cln.].

Oxyblepta limbatipennis Stål

1873. *S[tenopola] (Oxyblepta) limbatipennis* Stål, Recensio Orth., I, p. 85. [♂; Remedios, [Antioquia], Colombia.]

[53] Recorded as *Leptysma obscura* (Thunberg), by Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 804, (1906).

[54] Male from this locality selected as single type; Hebard Collection, Type no. 313.

[55] Male from this locality selected as single type; Hebard Collection, Type no. 314.

Porto Bello, Panama, II, 25 to III, 16, 1911, (A. Busck), 1 ♂, 3 ♀, 1 juv.

France Field, Cristobal, C. Z., Pan., VIII, 18, 1920, (Hebard; few in vine tangles on edge of low, heavy, swamp forest), 2 ♂, 1 ♀.

Gatun, C. Z., Pan., VII, 12 to VIII, 22, 1916, (D. E. Harrower), 7 ♂, 7 ♀; VII, 8, 1920, (Hebard; in open grasslands), 1 ♀.

Gold Hill, C. Z., Pan., XI, 14, 1913, (Hebard; from heavy tangle of vines in bushy area), 1 ♀.

Paraiso, C. Z., Pan., I, 16, 1911, (A. Busck), 1 ♀.

Tabernilla, C. Z., Pan., VI, 18, 1907, (A. Busck), 1 ♀.

Rio Trinidad, Pan., III, 17, 1912, (A. Busck), 1 ♀.

Cabima, Pan., V, 28, 1911, (A. Busck), 1 ♀.

Comparison has recently been made with Colombian material.[56] This is the species recorded by Giglio-Tos, from the Rio Cianati and Laguna Pita, Darien, Panama, as *Stenopola xanthochlora*,[57] which records were repeated by Bruner in the Biologia.

Group *Tetrataeniae*

Cornops longipenne (DeGeer)

1773. *Acrydium longipenne* DeGeer, Mém. l'Hist. Ins., III, p. 501, pl. 42, fig. 9. [Surinam.]

Panama City, Panama, 1912, (J. Zetek), 1 ♀, [Hebard Cln.].

The unstudied collections before us show this species to have a wide distribution in northern South America, the present being the first Central American record.

Group *Copiocerae*

Copiocera harroweri new species (Plate VII, figures 4 and 5.)

This large and handsome species is structurally nearest *C. specularis* Gerstaecker,[58] the pronotum ith sulcus just before the cephalic margin being more decided, the metanotum broader and more flattened than in any of the South American species before us. Like in *specularis*, the sulcus toward the cephalic margin of the pronotum is usually darkened.

[56] Trans. Amer. Ent. Soc., XLIX, p. 249, (1923).

[57] Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, no. 301, p. 4, (1897).

[58] A species originally described from Panama, which has subsequently been recorded from various localities in Costa Rica.

The present insect is slightly larger and more robust than *specularis*, the pale tips of the antennae are more extensive and conspicuous, the wings proximad are weakly purplish instead of distinctly blue, the mesonotum, metanotum and abdominal tergites are solidly red, except for ventro-lateral blackish blotches and the internal and ventral surfaces of the caudal femora are maroon (in *specularis* olivaceous black).

South American material of *C. laeta* Gerstaecker and *C. erythrogastra* (Perty) before us has the ventral and internal surface of the caudal femora likewise maroon, but in those species there is a broad pregenicular annulus of buffy.

Type.— ♀ ; Gatun, Canal Zone, Panama. July 17 to 23, 1916. (D. E. Harrower.) [Hebard Collection, Type no. 915.]

Size large, form robust for this genus of rather large, slender species. Antennae nearly as long as caudal femora. Interocular space nearly twice as wide as frontal costa. Fastigium moderately depressed below level of occiput, moderately acute but with apex blunt, medio-longitudinal sulcus subobsolete. Frontal costa showing coarse but weak lateral carinae in dorsal portion. Pronotum with metazonal portion of disk flattened and broadened, with distinct though broadly rounded shoulders; surface cribroso-punctate, transverse sulci decided, medio-longitudinal carina indicated finely only on metanotum; caudal margin of disk broadly and evenly rounded (sometimes showing a trace of median emargination). Prosternal spine transverse, broadening distad, with broadly transverse apex rounded. Tegmina and wings considerably surpassing apex of abdomen. Tegmina with costal margin evenly and weakly convex; sutural margin straight, showing a trace of broad and very weak concavity before the rather broadly rounded apex. Ventral surface of abdomen distad decidedly hairy. Cerci simple, straight, very slender and elongate, almost spiniform. Ovipositor valves represented by comparatively small, unarmed fingers, the dorsal curved outward, the ventral much smaller and curved downward. Cephalic and median limbs comparatively small. Caudal femora rather slender. Caudal tibiae armed with the series of three and three spines which are characteristic of *Copiocera*.[59] Caudal tarsi elongate, the third joint longer than the first, the second slightly over half as long as the first.

Allotype.— ♂ ; same data as type. [Hebard Collection.]

Agrees closely with female, differing as follows. Size decidedly smaller, form less robust. Antennae longer than caudal

[59] Occasional individuals show two instead of three spines in the first set. This we find to be a feature of individual variation in other species of *Copiocera* as well.

femora. Interocular space less than twice as wide as frontal costa. Fastigium with medio-longitudinal sulcus slightly more distinct. Genitalia much as in *specularis*. Very small furcula present. Supra-anal plate scarcely longer than broad, free margins nearly parallel proximad, then nearly transverse and concave to the rounded apex. Cerci very elongate and very slender straight, nearly as slender as in female. Subgenital plate convex, dorsal margins laterad broadly convex, showing a brief but broad and very weak concavity on each side of the weakly convex median (apical) portion, this small and very weakly produced area with surface feebly concave.

Coloration of sexes similar. Head, pronotum and tegmina buffy brown; mouthparts decidedly darker with mandibles black, pronotum with sulcus near and paralleling cephalic margin usually suffused with blackish (as is also frequently the case in *specularis*), tegmina often with veins decidedly olivaceous as far as distal portion. Antennae blackish, with five terminal joints strikingly cinnamon-buff. Wings hyaline with a decided tinge of buffy brown, veins deep chestnut brown with costal margin and apex of anterior field suffused with this color, the radiate field proximad showing a tinge of pallid grayish violet-blue. Mesonotum and metanotum pansy purple, shading into the deep and brilliant nopal red of the abdominal tergites, which are marked solely with patches of suffused blackish at their intersections latero-ventrad. These patches are variable, but average decidedly wider in the females than in the males. Pleura, ventral surface of abdomen and cephalic and median limbs buffy brown, ventral surface of thorax and external surface of cephalic femora sometimes darker. Caudal femora with dorsal and external surfaces buffy brown, internal and ventral surfaces maroon, sometimes brightening to deep nopal red distad; genicular areas antimony yellow to ochraceous-buff dorsad, this slightly suffused with brown latero-internally but with ventral portion of the latter blackish. Caudal tarsi buffy brown externally, darker and tinged with maroon internally.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Width of pronotum at shoulders	Length of tegmen	Greatest width of tegmen	Length of caudal femur
Gatun, *allotype*	36.1	5.9	3.6	33	4.1	17.9
Gatun, *paratype* ...	35	5.6	3.4	31	3.9	16.9
Porto Bello, *paratype*	31.8	5.3	3.1	28	3.8	15.4
♀						
Gatun, *type*.....	50.2	8.2	5.7	46.5	6.4	21.7
Gatun, *paratype* ...	48.8	8.4	5.8	44.7	6.7	21.7
Gatun, *paratype* ...	50.8	8.2	5.7	45.7	6.1	22.3
Gatun, *paratype* ...	50.1	8.2	5.7	45.7	6.1	22.1

We take pleasure in naming this handsome grasshopper in honor of its collector, Mr. D. E. Harrower, whose energetic field work in Panama has resulted in the discovery of many new species of Orthoptera.

Specimens Examined: 7; 3 males and 4 females.

Porto Bello, Panama, II, 15, 1911, (A. Busck), 1 ♂.

Gatun, Canal Zone, Pan., VII, 12 to 23, 1916, (D. E. Harrower; "always on palms"), 2 ♂, 4 ♀, *type*, *allotype* and *paratypes*.

Group *Coscineutae*

Poecilocloeus rhabdotus new species (Plate VII, figure 6.)

This insect belongs to a very large tropical South American genus,[60] of which few of the species are yet described. In position *Poecilocloeus* comes before *Leioscapheus* and follows a yet undescribed Central American genus, which must be erected to include the species, described by Bruner, as *Coscineuta olivacea*, from Nicaragua. That genus is preceded by the distinctive Mexican genus *Proctolabus*.

The present species is particularly distinguished by the very brief pale antennal apices, a broken postocular yellowish band on each side, the caudal femora with conspicuous yellowish annuli before the dark genicular areas, and the green caudal tibiae. Discovery of the male will doubtless show very distinctive genitalic specialization, as is the rule in *Poecilocloeus*.

Type.— ♀ ; Gatun, Canal Zone, Panama. July 6 to 22, 1916. (D. E. Harrower.) [Hebard Collection, Type no. 320.]

Size and form normal for the genus, medium and moderately robust. Head with eyes moderately prominent, interocular space narrow, slightly narrower than the very slender first antennal joint, showing faint longitudinal sulcation; fastigium pentagonal, as long as its greatest width (proximo-mesad), surface subrugulose and pitted to its bluntly transverse distal carina (which forms the truncate apex). Frontal costa produced in dorsal portion, there subequal in width, its smooth, flat surface with some impressed punctae; below median ocellus indicated only by a practically obliterated median sulcus; lateral carinae of face and infra-ocular sulci distinct, surface of face and genae strongly and thickly impresso-punctate, this much weaker caudad on genae and on occiput. Face moderately oblique, showing no concavity in lateral aspect. Antennae of medium length, very slender. Maxillary palpi not enlarged.

[60] See Trans. Amer. Ent. Soc., XLIX, p. 252, (1923).

Pronotum with surface thickly and strongly impresso-punctate; nearly cylindrical, showing weak shoulders in metazonal portion; disk with cephalic margin convexly produced on each side of an equal sized median concavity, caudal margin broadly convex; transverse sulci distinct; medio-longitudinal carina faintly indicated only on metazona. Prosternum swollen, bearing a small meso-caudal tubercle. Tegmina and wings somewhat reduced, extending about to median portion of genicular areas of caudal femora. Tegmina with principal veins all nearly longitudinal, showing very little specialization, apex rather broadly rounded and costal margin with a very weak, broad convexity meso-proximad. Wings cycloidal. Cephalic and median limbs simple, slender. Caudal femora heavy, carinae smooth, the dorsal carina minutely triangularly produced at genicular apex; all but internal portion of ventral surface finely and feebly impresso-punctulate; ventral margin of genicular areas rather strongly convex, disto-ventral projection rounded. Caudal tibiae supplied with long hairs, dorso-external margin armed with six to eight, and no distal, spines. Caudal tarsi with first joint approximately intermediate in length between the shorter second and elongate third joints.

Head, pronotum and pleura very dark olive green, the pronotum with dorso-lateral portion often showing a brownish suffusion, an interrupted postocular band of large yellowish spots (which individually varies to lime-green and cinnamon-buff) running to base of caudal femur; dorsum of pronotum with a slightly paler, interrupted band of similar spots on each side (in the series varying to absent, or very weakly indicated or nearly as pale as the lateral markings). Antennae brown, with immediate apices buffy. Tegmina warm sepia, becoming slightly paler and weakly metallic distad. Wings hyaline, very faintly tinged with glaucous-blue, this distinct only proximad, toward periphery very weakly suffused with brown. Mesonotum, metanotum and median segment light terre verte, abdomen and ventral surface courge green (often discolored). Cephalic and median limbs dark courge green, varying to hellebore green. Caudal femora dorsad and externally the same, ventrad and internally analine yellow; distad with a conspicuous and broad pregenicular annulus of buff yellow, the genicular areas and base of caudal tibiae blackish mummy brown (mars brown in one specimen). Other portions of caudal tibiae courge green darkening slightly distad. Caudal tarsi green dorsad, yellowish ventrad.

Measurements (in millimeters)

♀	Length of body	Width across eyes	Length of pronotum	Length of tegmen	Greatest tegminal width	Length of caudal femur
Gatun, *type*.....	28	4.8	4.8	18	3.8	13.8
Gatun, *paratypes* (4)	25.7	4.9	5.2	17.2	3.6	14.6
	28.8	5.1	5.4	17.9	3.8	15.2
Bocas del Toro	32	5.4	6.1	20.8	4.7	16.5

Specimens Examined: 6; six females.

Gatun, Canal Zone, Panama, VII, 17 to VIII, 22, 1916, (D. E. Harrower), 5 ♀, *type* and *paratypes*.

Bocas del Toro, Pan., VII, 1 to 10, 1908, (W. Robinson), 1 ♀.

Leioscapheus gracilicornis Bruner

1908. *Leioscapheus gracilicornis* Bruner, Biol. Cent.-Amer., Orth., II, p. 267. [♀; Pozo Azul [de Pirrís], Costa Rica.]

Gatun, Canal Zone, Panama, VII, 19 to 22, 1916, (D. E. Harrower), 1 ♀.

Panama City, Pan., 1912, (J. Zetek), 1 ♀, [Hebard Cln.].

The cycloidal wings in this species are hyaline, evenly tinged with blue, except for a very broad, solidly suffused band of brown about their peripheral margin.

The organs of flight show a somewhat different degree of reduction in the two females, the tegminal length being, for the Gatun specimen 10 4, and for the Panama City individual 11 mm.

ANNICERIS Stål

The Peruvian genotype, *geniculatus*, was selected by Rehn, in 1905. It is evident that two generic units have here been included. To *Anniceris*, sensu strictiore, belong *geniculatus* Stål, *nigrinervis* Stål[61] and *Jodacris* (?) *costaricensis* Rehn.[62] The other species which have been assigned to *Anniceris* are all referable to the genus *Ampelophilus*, here described, where full comparisons are made.

The position of *Anniceris* has been somewhat uncertain, due largely to misleading features given in Giglio-Tos' key. It was evidently due to this situation that Rehn assigned *costaricensis*, with a query, to *Jodacris*. In that key[63] the section for the

[61] The female from Guatemala, so recorded by Bruner in the Biologia, however, represents a different species.

[62] This species has subsequently been incorrectly referred to *Chrysopsacris*, which genus we have found to be a synonym of *Bucephalacris*.

[63] Boll. Mus. Zool. Anat. Comp. Univ. Torino, XIII, no. 311, p. 46, (1898).

Coscineutae gives the second caudal tarsal joint as subequal in length to the first. In *Anniceris* this is not true, the genus there running to the *Aleuae* as a result, but incorrectly, as it certainly belongs near *Proctolabus* and its allies. As described by Stål, *Anniceris* has the first joint of the caudal tarsi almost twice as long as the second. The caudal tibiae normally have seven (very rarely six) dorso-external spines. The swollen prosternum is surmounted by a minute but sharp tubercle. The male has the supra-anal plate almost evenly shield-shaped, and supplied with a few minute, black tubercles, with surface at apex not raised in a node and the margin of the preceding tergite thickened and very dark, with two minute, black projections (the furcula?) beneath.

Anniceris nigrinervis Stål

1877. *A*[*nniceris*] *nigrinervis* Stål, Bih. till K. Svenska Vet.-Akad. Handl., v, no. 4, p. 83. [♂, Colombia.]

Cabima, Panama, V, 18, 1911, (A. Busck), 1 ♂, 1 ♀.

France Field, Cristobal, Canal Zone, Pan., VIII, 18, 1920, (Hebard; found locally perching on upper surfaces of vine leaves covering bushes on edge of low, heavy, swamp forest; individuals jumped powerfully but were not very alert), 3 ♂, 3 ♀, 2 juv.

Close affinity is shown by *A. costaricensis* (Rehn), which species differs only in the slightly more abruptly truncate fastigium and the bright (vinaceous-rufous to carnelian red) coloration of nearly the entire cephalic half of the caudal femora.

In *nigrinervis* the caudal femora are entirely green except for the carnelian red genicular areas.[64] The black humeral line on the green tegmina is very weak in one male, obsolete in another individual of the same sex.

The specimens before us have the broadly lanceolate and slightly overlapping tegmina distinctly shorter than in the type, which is described as having these organs almost twice as long as the pronotum. Though our specimens are quite constant in this respect, we do not believe that this difference alone would warrant our recognizing the Panamanian insect as distinct.

[64] These genicular areas are similarly colored in *costaricensis*.

Length of body, ♂, 11.8 to 12.4; ♀, 16.8 to 16.2: length of pronotum, ♂, 3.1 to 3.2; ♀, 4 to 4.3: caudal width of pronotal disk, ♂, 2 to 2.1; ♀, 3 to 3.1: exposed length of tegmina, ♂, 3.8 to 3.7: ♀, 5.9 to 5.8: length of caudal femur, ♂, 7.7 to 7.8; ♀, 8.9 to 9.3 mm.

This is one of the most brilliantly colored of the small, flightless, vine-dwelling grasshoppers found in Panama.

AMPELOPHILUS new genus

This genus is erected to include five species,[65] which hitherto have been referred to *Anniceris*. These, in chronological order, are the Panamanian *geniculatus* (Stål), the Costa Rican *truncatus* (Rehn), the Mexican *viridulus* (Bruner) and that author's two Costa Rican species *meridionalis* and *apicalis*.

Compared with *Anniceris* the present genus is found to differ in the larger size, less compact form, more produced fastigium, more prominent eyes, decidedly more elongate tegmina, pronotum with caudal margin of disk strongly transverse and showing very feeble convexity,[66] swollen prosternum without any tubercle and longer second joint of the caudal tarsi, so that the first joint is about intermediate in length between the shorter second and the elongate third joints. The genitalic specialization is generally similar, except that in *Ampelophilus* the male has the lateral margins of the supra-anal plate concave toward the produced apex, with surface there bearing a raised node, while the female has the ovipositor valves proportionately longer and more slender.

Genotype.—*Ampelophilus meridionalis* (Bruner).

In this genus the caudal tibiae are terete and lack a distal dorso-external spine.

Ampelophilus olivaceus (Giglio-Tos)

1897. *A[nniceris] olivaceus* Giglio-Tos, Boll. Mus. Zool. Anal. Comp. Univ. Torino, XII, no. 301, p. 4. [♀; Punta de Sabana, Darien, [Panama].]

Gatun, Canal Zone, Panama, VII, 17 to 23, 1916, (D. E. Harrower), 1 ♀.

[65] The Philadelphia collections contain the types of *truncatus*, *meridionalis* and *apicalis*.

[66] Described as very obtusely rounded for *Anniceris*, but in all the species of that genus known to us showing broad but distinct obtuse-angulate production, with apex rounded.

Gold Hill, C. Z., Pan., XI, 14, 1913, (Hebard; from heavy tangle of vines in bushy area), 2 juv. ♂, 1 juv. ♀.

Taboga Island, Pan., VI, 13, 1911, (A. Busck), 1 juv. ♂.

This insect may be distinguished from *A. meridionalis* (Bruner), to which species nearest relationship is shown, by the more reduced tegmina, which are broadly oval and are widely separated. The coloration is very similar, olive, differing only in having the occiput and genae more bluish green. Discovery of the adult male is awaited with interest.

The lateral carinae of the face are rounded and not prominent in this and the Costa Rican forms. Differences in this character are not sufficiently marked to be used as a key character to separate these species, as has been done by Bruner in the Biologia.

Coscineuta coxalis (Serville)

1839. *Acridium coxale* Serville, Hist. Nat. Ins., Orth., p. 672. [♀: Peru; Colombia.]

Gatun, Canal Zone, Panama, VIII, 6 to 22, 1916, (D. E. Harrower; on leaf, edge of forest), 1 ♀.

Rio Chagres, C. Z., Pan., X, 9, 1917, (H. Morrison), 1 ♂.

Frijoles, C. Z., Pan., X, 10, 1917, (H. Morrison; from avocado tree), 1 ♀, [U. S. N. M.].

We have recently recorded this handsome insect from three Colombian localities. It has been reported from Punta de Sabana and Tin-Tin by Giglio-Tos. It is readily distinguished by the general dark green coloration, with areas of yellowish green, the faint though somber blue tinge of the transparent wings, and the bright nopal red (rarely as pale as coral red) coxae.

Group *Phaeopariae*

Phaeoparia rotundata Stål

1878. *P[haeoparia] rotundata* Stål. Bih. till K. Svenska Vet.-Akad. Handl., v, no. 4, p. 57. [♂; Chiriqui, Panama.]

Porto Bello, Panama, VIII, 18 to 22, 1916, (D. E. Harrower), 1 ♂, 2 ♀.

Gatun, Canal Zone, Pan., VII, 12 to VIII, 22, 1916, (D. E. Harrower; common on forest trails and widely distributed), 6 ♂, 25 ♀, 5 large juv.; IX, 1 to 7, 1922, (D. E. Harrower), 1 ♂, 1 ♀, 1 large juv., [A. N. S. P.].

Lion Hill, C. Z., Pan., VII, 26, 1907, (A. Busck), 1 ♂.

Cabima, Pan., V, 21 to 29, 1911, (A. Busck), 1 ♂, 1 ♀, 1 large juv.

Alhajuela, Pan., IV, 9 and 18, 1911, (A. Busck), 2 juv.

Rio Trinidad, Pan., III, 20, 1912, (A. Busck), 1 juv.; V, 2 to VI, 9, 1911 and 1912, (A. Busck), 2 ♂, 2 ♀.

This insect is very closely related to the Colombian *P. annulicornis* Stål,[67] but may be readily distinguished by the longer antennae, shorter tegmina with apices rounded instead of showing obliquity, the wings which are tinted uniformly with grenadine instead of becoming geranium pink (pinker and less orange) proximad, and male with broader supra-anal plate and apical portion of the subgenital plate.

Stål was apparently in error as to the apparent specific differences in antennal and tegminal coloration. The antennae are feebly annulate in both series before us, while the dark and shining tegminal maculae are usually well developed in females (rarely subobsolete), but usually absent in males, though traces of such in the form of minute flecks occur in males of *rotundata*.

The extremes in the present material are shown in the Gatun series, as follows: length of body, ♂, 23 to 23; ♀, 34.5 to 36.4: length of antenna, ♂, 14 to 14.2; ♀, 10.9 to 10.9: length of pronotum, ♂, 4.8 to 5.1; ♀, 6.8 to 7.1: caudal width of pronotal disk, ♂, 2.6 to 2.7; ♀, 3.7 to 3.8: length of tegmen, ♂, 13.2 to 13.9; ♀, 18.3 to 20: length of caudal femur, ♂, 15.8 to 15.8; ♀, 20 to 21.9 mm.

This is very probably the insect recorded from Panama by Giglio-Tos as *annulicornis*. The genus is widely distributed in tropical South America, the above constituting the only records from outside that continent.

Aristia depressicornis Bruner

1908. *Aristia depressicornis* Bruner, Biol. Cent.-Amer., Orth., II, p. 277. [Juv. [♂]; Juan Viñas, Costa Rica.]

Porto Bello, Panama, VIII, 18 to 21, 1916, (D. E. Harrower), 1 ♂.

This adult male clearly represents the species *depressicornis*, based on a large immature male.[68] The present adult shows

[67] We have recently discussed *annulicornis;* Trans. Amer. Ent. Soc., XLIX, p. 256, (1923).

[68] Hebard Collection, Type no. 329.

this species to be the most striking known member of the Phaeopariae, readily distinguished from all other species of *Aristia* in having fully developed tegmina and wings.

The following features are of value in distinguishing this handsome insect. Antennae elongate and flattened, sub-ensiform. Disk of pronotum sharply defined from lateral lobes by both color and lateral carinae; its surface flattened, with mediolongitudinal carina coarse and prominent on metazona, distinct on prozona but absent in its median section, with a pair of tubercles on each side near the cephalic margin, its pale surface with a dark V cephalad and a dark Y caudad. Tegmina falcate distad; light brown with numerous series of slightly darker patches irregularly but somewhat obliquely arranged in series, showing an oblique line of whitish flecks meso-distad as in *Phaeoparia linea-alba* (Linnaeus), dorsal surface paler but with darker flecks. Wings translucent orange-pink. Limbs mottled brown, except the cephalic femora which are olive-green to near their apices and thec audal femora which are dragons-blood red in distal half, the caudal tibiae similar but not as bright.

The male genitalia in the species of *Aristia* show no such decided specialization as in the species of *Phaeoparia*. For the present male these may be described as follows. Furcula triangular. Supra-anal plate simple. Cerci simple, straight, styliform. Subgenital plate slenderly conical.

Length of body, 34; length of antenna, 19.7; length of pronotum, 7.1; caudal width of pronotal disk, 3.7; length of tegmen, 27.3; greatest tegminal width, 6; length of caudal femur, 22.8 mm.

This is the only Central American species of *Aristia*, a genus represented in northern South America by a number of distinctive forms.

Group *Osmiliae*

Abracris obliqua (Thunberg)

1824. *Gr[yllus] obliquus* Thunberg, Mém. Acad. Imp. Sci. St. Petersb., IX, p. 414. [Brazil.]

David, Panama, VIII, 10, 1922, (D. E. Harrower), 1 ♀.

This obscure little insect has an extremely extensive distribution through, apparently, the drier portions of tropical North and South America.

Osmilia flavo-lineata (DeGeer)

1773. *Acrydium flavo-lineatum* DeGeer, Mém. l'Hist. Ins., III, p. 497, pl. 42, fig. 4. [[♀], Surinam (= Dutch Guiana).]

This insect is present and usually moderately numerous throughout Panama at all seasons; it has been recorded as *O. violacea* (Thunberg), from Colon, Punta de Sabana and the Rio Cianati by Giglio-Tos. It occurs in the forest undergrowth and is particularly numerous in the low vegetation of the forest margins. Slow and not particularly wary, individuals often fly short distances when disturbed, but rarely at more than a few feet above the ground.

The present series of sixty-six males, fifty-one females and forty-four immature individuals was secured at the following localities. Mouth of Rio Nargana on Gulf of San Blas, Porto Bello, Guamina on Rio Chagres, France Field near Cristobal, Gatun, Lion Hill, Rio Trinidad, Bohio, Juan Mina Plantation on Rio Chagres, Alhajuela, Zone limit five miles west of Empire, Gold Hill, Culebra, Paraiso, Pedro Miguel, Corozal, Ancon, Panama City, Cabima, Pinogana, Taboga Island and David.

Group *Vilernae*

Vilerna aeneo-oculata (DeGeer)

1773. *Acrydium aeneo-oculatum* DeGeer, Mém. l'Hist., Ins., III, p. 502, pl. 42, fig. 11. [Surinam.]

Taboga Island, Panama, VI, 12, 1911, (A. Busck), 1 ♂.

France Field, Cristobal, Canal Zone, Pan., VII, 7, 1920, (Hebard; in heavy foliage on high ground and in vine tangle on edge of low, heavy swamp forest), 1 ♂, 1 ♀.

Gatun, C. Z., Pan., VI, 1915, (D. E. Harrower), 1 ♀; VII, 12 to 15, 1916, (D. E. Harrower), 1 very small juv.

Juan Mina Plantation, C. Z., Pan., 1919, (J. Zetek), 1 ♀, [U. S. N. M.].

Paraiso, C. Z., Pan., I, 15, 1911, (A. Busck), 1 juv.

Corozal, C. Z., Pan., XI, 17, 1913, (Hebard; beaten from low plants in undergrowth of forest), 2 juv. and 1 very small juv.

The size contrast between the two males of the present series is great; length of body, 20.8 and 23.8; length of pronotum, 4.2 and 5; length of tegmen, 16.8 and 19.1; length of caudal femur, 10.8 and 12.4 mm.

In the early stages of immaturity the antennal joints are particularly irregular, bluntly triquetrous and in consequence showing a very unusual contour.

The males have the dorsum slightly paler than the sides, the females showing scarcely any color difference in these areas.

The species has an extensive distribution in tropical North and South America, and has been recorded by Giglio-Tos from Punta de Sabana. Lake Pita, Tin-Tin and the Rio Lara.

Vilerna corticina new species (Plate VII, figure 7.)

This is a small species with rudimentary tegmina. It is closely related to the Colombian *V. reducta* Brunner, known from a unique male. Compared with the description and figures of that specimen, we find the present insect to differ in the smaller size [69] and broader tegmina, which are less reduced, exceeding the pronotum in length and separated by a very narrow interval. The coloration of the ventro-internal portions of the caudal femora is also less brilliant in the present individual.

Type.— ♀ ; Boquete, Chiriqui, Panama. August 15 to 20, 1922. (D. E. Harrower.) [Acad. Nat. Sci. Phila., Type no. 5384.]

Size small, form moderately robust. Fastigium produced, though not as strongly as in *V. aeneo-oculata* (DeGeer), similarly with surface flattened and margins distad finely but prominently carinate, not rounding as evenly to apex and consequently appearing angulato-convex. Irregular carinae of ventral portion of frontal costa, facial carinae and infra-ocular sulcus decided. Eyes short, over three-quarters as wide as long (in *aeneo-oculata* only three-fifths as wide as long). Antennae moderately thickened and flattened, with joints proximad slightly irregular (not as much thickened and flattened proximad as in *aeneo-oculata*). Pronotum with caudal margin nearly transverse, showing only very weak angulate-convexity; medio-longitudinal carina coarse on prozona and in lateral aspect weakly convex between the sulci, very weak on metazona; surface ruguloso-impresso-punctate. Prosternal spine moderately elongate and rather sharply conical. Tegmina represented by lateral pads, roughly broad-ovate, the apices bluntly rounded, the costal margin showing decided convexity mesad; covered by a coarse network of veins, with principal vein distinct and definition between dorsal and lateral fields faintly indicated. Abdomen dorsad medio-longitudinally carinate. Ovipositor valves short, with cutting margins coarsely crenulate and the apices feebly curved.

[69] That male being nearly as large as the present female.

Limbs short; caudal femora decidedly shorter than in *aeneo-oculata*, caudal tibiae with six to seven external (but no distal) spines.

General coloration mummy brown weakly streaked with darker, shading to dull russet on abdomen. Face, infra-ocular portion of genae and ventral portions of pronotal lateral lobes snuff brown, this narrowing caudad on the latter and its dorsal margin consequently moderately oblique. Eyes shining auburn. Tegmina paling slightly distad, there buffy-brown overlaid with mummy brown and with flecks of blackish. Caudal femora dorsad and externally similar, blackish flecks along the dorsal and dorso-external carinae, the ventro-internal surface dull yellowish. Caudal tibiae dull brown; the spines buffy, black tipped.

Measurements of female. Length of body, 20.8; length of antenna, 6; width across eyes, 4; length of pronotum, 4.7; caudal width of pronotal disk, 3.4; exposed length of tegmen, 5.7; greatest tegminal width, 3.1; width of interval between tegmina, .8; length of caudal femur, 10.3; greatest width of caudal femur, 2.9 mm.

The type of this inconspicuous grasshopper is unique.

Group *Cyrtacanthacri*

Schistocerca impleta (Walker)

1870. *Cyrtacanthacris impleta* Walker, Cat. Dermapt. Saltat. British Mus., III, p. 554. [♀, West Coast of America.]

Porto Bello, Panama, IV, 21, 1912, (A. Busck), 1 ♀.

Taboga Island, Pan., II, 22 and 26, 1912, (A. Busck), 2 ♀.

Gatun, Canal Zone, Pan., VII, 12 to VIII, 22, 1916, (D. E. Harrower), 12 ♂, 27 ♀, 11 juv. (representing four instars).

Gold Hill, C. Z., Pan., XI, 14, 1913, (Hebard), 1 ♂.

Tabernilla, C. Z., Pan., V, 1907, (A. Busck), 1 ♀; VII, 27, 1907, (A. Busck), 1 small juv.

Paraiso, C. Z., Pan., I, 7, 1911, (A. Busck), 1 ♂.

Zone limit five miles west of Empire, C. Z., Pan., XI, 14, 1913, (Hebard), 1 ♂, 1 ♀.

Pedro Miguel, C. Z., Pan., VI, 9, 1915, (D. E. Harrower), 2 ♂, 1 ♀.

Corozal, C. Z., Pan., V, 4, 1912, (A. Busck), 1 ♂.

Ancon, C. Z., Pan., 1912, (J. Zetek), 3 ♀, [Hebard Cln.].

La Chorrera, Pan., V, 1912, (A. Busck), 1 ♂, 1 ♀.

Cabima, Pan., V, 20, 1911, (A. Busck), 1 ♂, 4 ♀.

Alhajuela, Pan., IV to V, 28, 1911 and 1912, (A. Busck), 2 ♂, 2 ♀.

Limon Plantation, Rio Chagres, Pan., VII, 14, 1918, (Dietz and Zetek; about corn field), 1 ♀.

The following variation in color and color pattern is found in the present series. Dorso-longitudinal pale band distinct to very weak, usually obsolete in caudal portion of pronotal metazona. Pronotum with lateral lobes usually immaculate or very obscurely suffused; in intensive examples sometimes with a poorly defined and suffused band, mesad and longitudinal, situated between the cephalic margin and the second sulcus, then strongly oblique ventrad to the principal sulcus, obsolete in the metazonal portion. Tegmina with discoidal field usually irregularly and rather obscurely marked with dark patches, these sometimes in strong contrast,[70] occasionally obsolete in pale, recessive individuals. Caudal femora usually with blackish dots on carinae, these often very weak, and absent in all recessive individuals. Caudal tibiae cinnamon-buff to olive-buff, heavily flecked with dark brown in intensive individuals, varying to immaculate in the balance of the series; spines and spurs always much paler, pale pinkish-buff, with apices blackish.

A distinctive condition, though apparently merely representing a color phase of the species, occurs along the Pacific side of the Isthmus, which, were Panamanian material alone considered, might easily have been given nominal recognition. A large Costa Rican representation, however, shows that, in that country, both of these types are to be found in practically every series.

The specimens in question are listed separately as follows:

Pedro Miguel, Canal Zone, Panama, VI, 9, 1915, (D. E. Harrower), 1 ♀.

Ancon, C. Z., Pan., 1912, (J. Zetek), 1 ♂, 1 ♀, [Hebard Cln.].

Boquete, Chiriqui, Pan., VIII, 15 to 20, 1922, (D. E. Harrower), 3 ♂, 1 ♀.

David, Chiriqui, Pan., VIII, 10, 1922, (D. E. Harrower), 1 ♂, 1 ♀.

These individuals differ in having the caudal tibiae pompeian

[70] Particularly in the two females from Taboga Island.

red to coral red, the antennae and other tibiae and tarsi tinged with this color.[71]

Schistocerca paranensis (Burmeister)

1861. *Acridium paranense* Burmeister, Reise durch La Plata Staaten, I, p. 491. [La Plata region and Province of Entrerios, [Argentina]; Paraná [River].]

We have recently discussed this insect,[72] whose ravages are known to extend from the Argentine to southern Mexico.

Corozal, Canal Zone, Panama, 2 ♂, 2 ♀, [U. S. N. M.].

Ancon, C. Z., Pan., 1912, (J. Zetek), 1 ♀, [Hebard Cln.].

The following information is attached to the Corozal specimens. "This grasshopper arrived here July 10th. The air has been pretty well filled with them during daylight ever since, though a very small proportion alight in this vicinity. It is reported that they have done much damage in Cocole and other provinces."

It is almost certainly this species which Giglio-Tos recorded as *peregrina* from Punta de Sabana, Lake Pita, Tin-Tin and the Rio Lara.

Schistocerca separata Scudder

1899. *Schistocerca separata* Scudder, Proc. Amer. Acad. Arts and Sci., XXXIV, p. 469. [♂, ♀ : Chontales, Nicaragua; Costa Rica.]

Bocas del Toro, Panama, VII, 1 to 10, 1908, (W. Robinson), 1 ♂.

[71] Except in the David female, which has these latter portions buffy and is intensive in coloration.

[72] Trans. Amer. Ent. Soc., XLIX, p. 281, (1923). At that time we had not received Uvarov's paper "Notes on Locusts of Economic Importance, with some New Data on the Periodicity of Locust Invasion," (Bull. Ent. Research, XIV, pp. 31-39, July, 1923). In that paper *Acridium peregrinum* Olivier is placed as a synonym of *Schistocerca gregaria* (Forskal), not the same as *Gryllus* (*Locusta*) *tataricus* Linnaeus, as indicated by Kirby in 1910. We fully agree with Uvarov in his decision that the presence of *gregaria* in the New World has not been proved. In fact we believe that it does not exist on this continent. There are in American museums, as in the British Museum, a few very old specimens of *gregaria* labelled as from various parts of South America. The great majority of records of "*peregrina*" from the New World are, however, due to misidentification of material actually representing *S. paranensis* (Burmeister) and the few others probably to erroneous labelling. Among the hundreds of thousands of specimens of grasshoppers collected in America in the past twenty years, we do not know of a single example of undoubted *gregaria*.

The distribution of this handsome insect is now known to extend from Chontales, Nicaragua, to Buenaventura, Colombia.

Group *Melanopli*

Aidemona azteca (Saussure)

1861. *Platyphyma azteca* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 161. [♂, Temperate Mexico.]

Taboga Island, Panama, VI, 9, 1911, (A. Busck), 1 juv.; VII, 6, 1910, (A. H. Jennings), 1 juv.

Gatun, Canal Zone, Pan., VII, 12 to VIII, 22, 1916, (D. E. Harrower), 10 ♂, 14 ♀, 12 juv.

Bocas del Toro, Pan., VII, 1 to 10, 1908, (W. Robinson), 1 juv.

Guamina, Rio Chagres, Pan., III, 5, 1922, (G. H. H. Tate), 1 ♀.

Tabernilla, C. Z., Pan., VI, 18 and 25, 1907, (A. Busck), 2 juv.

Paraiso, C. Z., Pan., I, 15 to II, 1911, (A. Busck), 1 ♂, 5 ♀, 3 juv.

Zone limit five miles west of Empire, C. Z., Pan., XI, 14, 1913, (Hebard), 3 ♂.

Gold Hill, C. Z., Pan., XI, 14, 1913, (Hebard), 3 ♂, 1 ♀.

Ancon, C. Z., Pan., XI, 12 and 13, 1913, (Hebard; in short grass and low vines), 1 ♂, 3 ♀.

Old Panama, Pan., I, 31, 1911, (A. Busck), 1 juv.; XI, 13, 1913, (Hebard; beaten from short grass), 1 juv.

La Chorrera, Pan., V, 22, 1912, (A. Busck), 1 juv.

David, Chiriqui, Pan., VIII, 10, 1922, (D. E. Harrower), 3 ♂, 3 ♀.

Decided size difference between the extremes of the males is shown, as follows: length of body, 12.6 to 17.2; length of tegmen, 10.7 to 13.7; length of caudal femur, 8.8 to 9.8 mm.

The immatures frequently show a very distinctive coloration, in having a curved band laterad on head and pronotum and markings on the caudal femora of yellowish buff.

The species is known from central Mexico southward to Cali, Colombia.

Group *Rhytidochrotae*

Piezops[73] **ensicornis** (Stål) (Plate VII, figure 8.)

1878. *R[hytidochrota] ensicornis* Stål, Bih. till K. Svenska Vet.-Akad. Handl., v, no. 4, p. 76. [♂, Panama.]

[73] We have recently described the monotypic genus *Piezops;* Trans. Amer. Ent. Soc., XLIX, p. 296, (1923).

Porto Bello, Panama, II, 24, 1911, (A. Busck), 1 large juv. ♂, 1 large juv. ♀; IV, 17, 1912, (A. Busck), 1 ♂.

The present adult is colored as follows.[74] Antennae black. Body entirely blackish brown, except the second to fourth abdominal tergites, which are ferruginous in all but narrow meso-caudal portion. Caudal femora and tibiae (except their apices) olivaceous black. Apices of caudal tibiae carnelian red. Limbs elsewhere apricot orange, shading to carnelian red on the tarsi.

Length of body, 25.5; length of antenna, 24; greatest width of antenna, 1.1; length of pronotum, 4.3; width across shoulders of mesonotum, 5.2; length of caudal femur, 20.7; length of longest spine of caudal tibia, 2 mm.

This is the first record of this extraordinary grasshopper since its original description.

Group *Pycnosarci*

Microtylopteryx nigrigena new species (Plate VI, figure 18; plate VII, figure 9.)

This handsome and extraordinary little grasshopper is a near relative of the Costa Rican *M. hebardi* Rehn.[75] From that species it may be distinguished by the slightly less elongate form, slightly longer head in proportion to the body bulk, pale unicolorous tegmina and, in the male sex, the solidly shining blackish brown face and genae.

Type.—♂; Gatun, Canal Zone, Panama. July 25 to 31, 1916. (D. E. Harrower). [Hebard Collection, Type no. 916.]

Size medium for genus, form sub-fusiform. Head somewhat compressed, its depth considerably greater than that of thorax; surface polished, face and genae impresso-punctulate, these few in number dorsad on genae; interocular space wide, twice as wide as the small first antennal joint; fastigium short, horizontal, slightly shorter than in *hebardi*, transverse, triangular, U-emarginate at apex, this due to the high lateral carinae and sulcation of the frontal costa which begin there; frontal costa slightly produced in dorsal portion, there broadly and simply sulcate between the high lateral carinae, below obsolete, as are the lateral carinae of the face, as in *hebardi*. Eye prominent, slightly

[74] Stål has stated that the color of this insect is apparently variable. Our specimen shows marked color difference from the original color description.

[75] We here designate as single type of *hebardi* the described male, from Carrillo, Costa Rica, Hebard Collection, Type no. 368.

longer than infra-ocular sulcus. Pronotum moderately tectate, lateral margins of disk curved dorsad in lateral aspect, median carina ascending cephalad, weak except for a slight elevation at cephalic margin, but forming a distinct ridge in the brief metazonal portion; disk rugoso-impresso-punctate, its cephalic margin broadly convex, its caudal margin broadly angulate emarginate; lateral lobes polished, with impressed punctulae ventrad, transverse sulci distinct, ventro-caudal margin very broadly rounded, this portion somewhat produced. Prosternum swollen, produced in a minute, but prominent, erect spine. Metanotum with a meso-caudal projection as on pronotum, but decidedly weaker; median segment with this present, but still weaker. Tegmina linear, lateral, width slightly greatest meso-distad, apex rather sharply rounded. Abdomen gradually tapering to apex, with a medio-longitudinal dorsal carina. Supra-anal plate very small, smooth, lateral margins strongly convergent proximad, the distal portion shield-shaped. Cerci very small, suddenly reflexed mesad with distal portion truncate and its internal margin lamellate, of the type developed in the genus *Oxyblepta*. Subgenital plate very small, produced, blunt conical distad.[76] Cephalic and median femora straight and not thickened. Caudal femora elongate, surpassing abdomen by decidedly over half their length; dorsal carina serrulate and produced in a minute angle distad, as in *hebardi*. Caudal tibiae with six, but no distal, dorso-external spines. Caudal tarsi with second joint very small, the third slightly longer than the combined length of the first and second joints.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

Agrees closely with male, differing as follows. Size much larger, form decidedly more robust. Fastigium shorter, width twice its length. Interocular space nearly three times width of proximal antennal joint. Eye distinctly shorter than infra-ocular sulcus. Ovipositor very short, the very strongly curved apices alone projecting. Caudal femora only slightly surpassing abdomen.

Coloration shining blackish brown, beautifully marked with pinkish buff exactly as in *hebardi*[77] except that the face and genae are solidly blackish brown, while the tegmina are uniform pinkish buff.

[76] The genitalia are much as in *hebardi*, except that the cerci are shorter, more suddenly reflexed and do not extend above the plane of the supra-anal plate, while the subgenital plate is shorter and more truncate.

[77] Fully described and figured by Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 449, fig. 40 and p. 450.

The measurements for the type and allotype are given first for their respective sexes. Length of body, ♂, 13 and 13.1; ♀, 23 to 23.2: length of antenna, ♂, 9.2 and 9.2; ♀, 7.5 to 7.5: width across eyes, ♂, 3.7 and 3.8; ♀, 4.7 to 4.7: length of pronotum, ♂, 3.8 and 3.9; ♀, 5.2 to 5.2: length of tegmen, ♂, 2.7 and 2.7; ♀, 3.2 to 3.2: width of tegmen, ♂, .3 and .4; ♀, .6 to .7: length of caudal femur, ♂, 11.3 and 11.7; ♀, 14.7 to 13.8 mm.

In addition to the described pair, a paratypic male, two paratypic females and an immature individual, bearing the same data but taken from July 12 to August 22, are before us.

Explanation of Plates

Plate VI

Fig. 1.—*Tylotettix simplex* new species. Cephalic view of head of male. Porto Bello, Panama. *Type.* (Much enlarged.)

Fig. 2.—*Tylotettix simplex* new species. Lateral outline of head and pronotum of male. Porto Bello, Panama. *Type.* (× 6)

Fig. 3.—*Platytettix harroweri* new species. Cephalic view of head of female. Gatun, Canal Zone, Panama. *Type.* (Much enlarged.)

Fig. 4.—*Platytettix harroweri* new species. Lateral outline of head and pronotum of female. Gatun, Canal Zone, Panama. *Type.* (× 6)

Fig. 5.—*Platytettix harroweri* new species. Dorsal outline of latero-caudal angle of pronotal lateral lobe of female. Gatun, Canal Zone, Panama. *Type.* (Greatly enlarged.)

Fig. 6.—*Platytettix panamae* new species. Lateral outline of head and pronotum of female. Porto Bello, Panama. *Type.* (× 6)

Fig. 7.—*Platytettix panamae* new species. Dorsal outline of latero-caudal angle of pronotal lateral lobe of female. Porto Bello, Panama. *Type.* (Greatly enlarged.)

Fig. 8.—*Otumba aciculata* new species. Dorsal view of head of male. Porto Bello, Panama. *Type.* (Much enlarged.)

Fig. 9.—*Otumba aciculata* new species. Dorsal outline of latero-caudal angle of pronotal lateral lobe of male. Porto Bello, Panama. *Type.* (Greatly enlarged.)

Fig. 10.—*Leuconotus gorgasi* new species. Dorsal outline of male vertex. Panama City, Panama. *Type.* (Much enlarged.)

Fig. 11.—*Taeniophora panamae* new species. Lateral view of male cephalic femur. Porto Bello, Panama. *Type.* (× 5)

Fig. 12.—*Taeniophora panamae* new species. Lateral view of male cercus. Porto Bello, Panama. *Type.* (Greatly enlarged.)

Fig. 13.—*Taeniophora panamae* new species. Dorsal view of apex of male cercus. Porto Bello, Panama. *Type.* (Same scale as figure 12.)

Fig. 14.—*Opshomala cylindrodes* (Stål). Lateral view of distal portion of male abdomen. Porto Alegre, Rio Grande do Sul, Brazil. (× 7)

Fig. 15.—*Opshomala cylindrodes* (Stål). Dorsal view of distal portion of male abdomen. Porto Alegre, Rio Grande do Sul, Brazil. (× 7)

Fig. 16.—*Opshomala goethalsi* new species. Lateral view of distal portion of male abdomen. France Field, Cristobal, Canal Zone, Panama. *Type.* (× 7)

Fig. 17.—*Opshomala goethalsi* new species. Dorsal view of apical projections of male subgenital plate. France Field, Cristobal, Canal Zone, Panama. *Type.* (Greatly enlarged.)

Fig. 18.—*Microtylopteryx nigrigena* new species. Gatun, Canal Zone, Panama. Lateral outline of distal portion of male abdomen. *Type.* (Much enlarged.)

Plate VII

Fig. 1.—*Leuconotus gorgasi* new species. Lateral view of male type. Panama City, Panama. *Type.* (× 2½)

Fig. 2.—*Chromacris psittacus* (Gerstaecker). Dorsal view of male. Gatun, Canal Zone, Panama. (Natural size.)

Fig. 3.—*Tropidacris latreillei* (Perty). Lateral view of head and pronotum of immature individual, showing distinctive color pattern, which does not occur in the adult. Colon, Panama. (× 3)

Fig. 4.—*Copiocera harroweri* new species. Dorsal view of female. Gatun, Canal Zone, Panama. *Type.* (Natural size.)

Fig. 5.—*Copiocera harroweri* new species. Lateral view of female abdomen. Gatun, Canal Zone, Panama. *Type.* (× 1½)

Fig. 6.—*Poecilocloeus rhabdotus* new species. Lateral view of female. Gatun, Canal Zone, Panama. *Type.* (× 2)

Fig. 7.—*Vilerna corticina* new species. Lateral view of female. Boquete, Panama. *Type.* (× 2)

Fig. 8.—*Piezops ensicornis* (Stål). Lateral view of male. Porto Bello, Panama. (× 2)

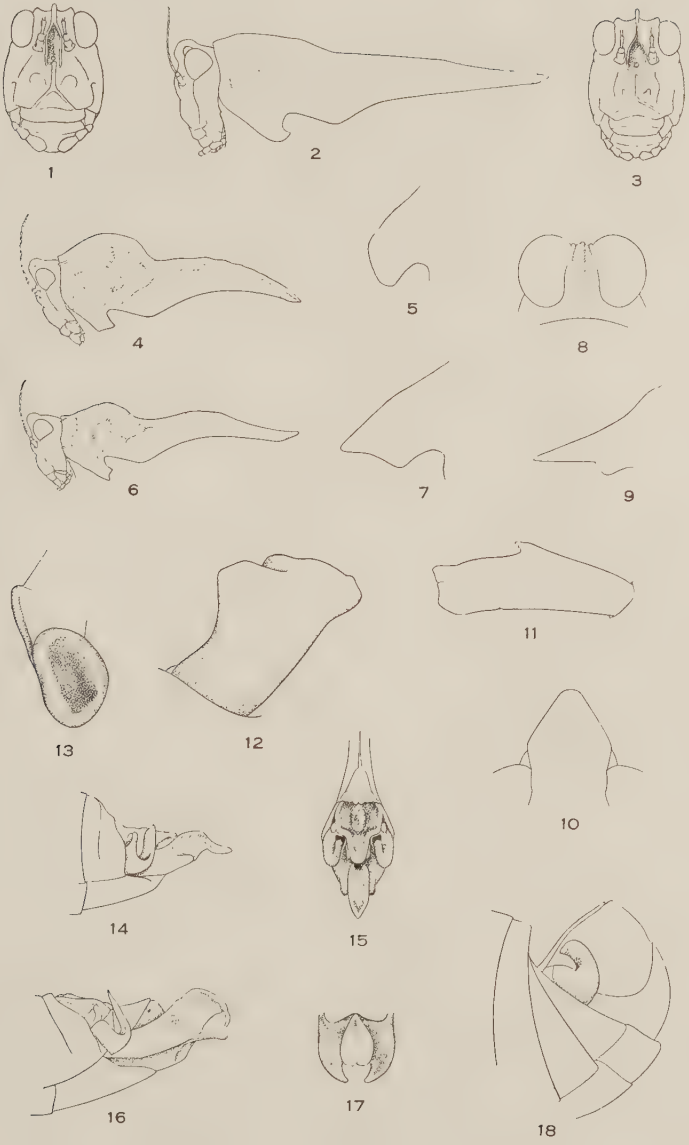
Fig. 9.—*Microtylopteryx nigrigena* new species. Lateral view of male. Gatun, Canal Zone, Panama. *Type.* (× 2)

Plate VIII

Fig. 1.—*Lophacris gloriosa* new species. Dorsal view of female tegmen and wing. Paraiso, Canal Zone, Panama. *Type.* (One-half natural size.)

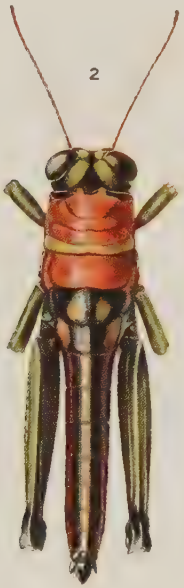
Fig. 2.—*Rhicnoderma magnificum* new species. Dorsal view of male. Gatun, Canal Zone, Panama. *Type.* (× 1½)

Fig. 3.—Characteristic undergrowth of Panamanian lowland forest. Courtesy of Dr. F. E. Lutz.



HEBARD—ACRIDIDAE OF PANAMA

HEBARD—ACRIDIDAE OF PANAMA



2

1

3

ON THE MALE GENITALIA OF THE HESPERIIDAE OF NORTH AMERICA

PAPER V

BY HENRY SKINNER AND R. C. WILLIAMS, JR.

This paper will treat of the genera *Augiades*, *Polites* and their allies. The records given are of insects which we have observed and in the collections of the Academy of Natural Sciences of Philadelphia and of R. C. Williams, Jr. The drawings of the male genitalia are directly traced from the parts mounted on slides. We have in general followed the nomenclature given by Lindsey in his paper on the Hesperioidea,[1] making only such changes in the arrangement as seem justified by the genitalic characters brought out.

1. **Atalopedes campestris** Boisduval (Fig. 1.)

Scudder, Butterflies of Eastern U. S., III, plate 37, figs. 21, 22, (1889) (as *huron*).

Godman and Salvin, Biol. Cent.-Amer., Rhop., III, plate 93, fig. 11, (1900).

Described from California; a widespread species, which occurs throughout the United States and south into Mexico and Central America.

The male genitalia are different from those of the allied genera in the blunt, incised projection of the uncus, the short blunt hooks extending beyond the upper portion of the uncus and the valve with its two upturned points.

Records: CALIFORNIA, Round Valley, Inyo County, October, (Poling); Los Angeles, June, July; San Bernardino; Riverside, March, September; ARIZONA, Gadsden (Schiffel); NEW MEXICO, Jemez Springs, September (Woodgate); TEXAS, Corpus Christi (Aaron); Round Mountain, Blanco County, June, October, November; Tiger Mill, April; San Antonio; Black Jack Springs; New Braunfels, May; Green Mill, April; MISSISSIPPI, Agricultural College, October (Weed); FLORIDA, Miami, January (Porter); St. Petersburg, January (Williams); Orlando, January

[1] Univ. of Iowa Studies in Nat. Hist., IX, no. 4, (1921).

(Williams); Rockledge; St. Augustine; North Carolina, Cranberry, August, September, October (Thomas); Tennessee, Nashville, July; Roan Station; Elizabethtown; Nebraska, Omaha, August, September, October (Leussler); Illinois, Quincy, October, November (Poling); Mexico, Mexico City, February (Williams); Panama, Colon, February (Williams).

2. **Augiades morrisoni** Edwards (Fig. 2.)

Type information, Southern Colorado. We are placing this species in the genus *Augiades*. While the maculation below is like that of *Pamphila*, the stigma more nearly resembles that of *Augiades*, and genitalically, the peculiar processes on the aedoeagus and the shape of the valvae show the close relationship of this species to the two following ones.

Records: Colorado, Salida, April (Bruce); New Mexico, Jemez Springs, May, June (Woodgate); Arizona (Morrison).

3. **Augiades agricola** Boisduval (Fig. 3.)

From California. The type locality of *yreka* Edwards, is San Francisco, California, and of *milo* Edwards, Mount Hood, Oregon. The white hyaline spots below the stigma are characteristic of the typical form. Edwards misidentified *agricola*, calling it *nemorum*, as attested by a specimen of *agricola* in the Academy's Collection labelled *nemorum* by him. The true status of *agricola* was not known, until the Oberthur figure of the type was published.[2]

Attention is called to the long slender terminals and hooks of the uncus, and the highly developed ornamentation of the terminal of the aedoeagus.

Records: California, Mill Valley, Marin County, April, September (Fox); Fairfax, Marin County, June, July (Hueguenin); Las Uvas, Santa Clara County, July (Hueguenin); Lagunitas Creek, Marin County, July; Diamond Canyon, Alameda County, June; Santa Rosa, May, June (Ricksecker); Riverside, May; San Diego, May, June; Los Angeles, June, July; Santa Cruz Mountains, Santa Clara County, September (Hueguenin); Pasadena; Nellie, June (Hewlett).

[2] Etud. Lep. Comp., ix. plate 240, fig. 2087, (1913).

Augiades agricola form **verus** Edwards

Type locality; Havilah, Kern County, California. This we believe to be a light colored form. Specimens from the type locality are genitalically identical with *agricola*. It may be distinguished from *nemorum* (which we place as a light variety of *sylvanoides* with immaculate secondaries below) by the indication of the hyaline spots next to the stigma, and by the whitish central line of the stigma being more pronounced in *verus* than in *nemorum*.

Records: California, Mount Breckenridge, Kern County, June (Grinnell).

4. **Augiades sylvanoides** Boisduval (Fig. 4.)

There is considerable variation in the appearance of the secondaries below. The color varies from ochreous brown to light yellow, and the discal band may be whitish, yellowish, obsolescent or obsolete.

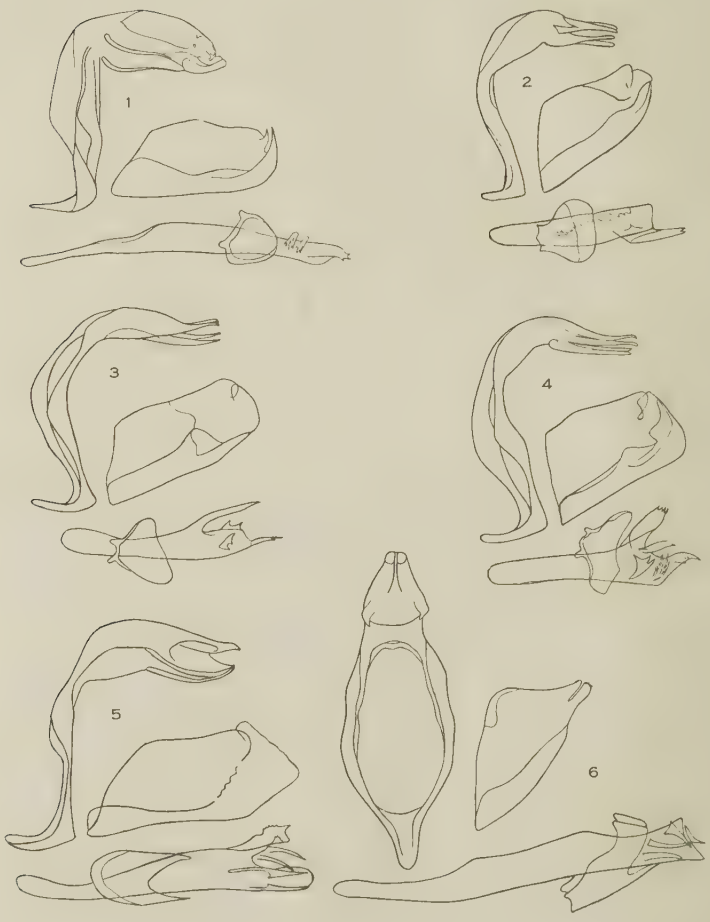
The male genitalia remain constant throughout these variations, and quite distinct from those of *agricola* in the shape of the terminal lobes of the valve and the terminal processes of the aedoeagus, and this organ carries a floating fascicule not present in *agricola*.

Records: California, San Bernardino, August (Wright); Los Angeles, September; Lake City, Modoc County, July (Fox); Santa Cruz, September (Dodge); Fairfax, Marin County, July, August, September (Fox); San Francisco, September (Hueguenin); Salem, August; Santa Cruz Mountains, Santa Clara County, September (Hueguenin); Nellie, August (Hewlett); San Bernardino Mountains, July, August; Fredalba, August; Los Angeles, June; Pasadena, September; Truckee, July; Calaveras County, June; Castella, Shasta County, June; Cedar Peak, Warner Mountains, August (Hebard); Cuyamaca Peak, San Diego County, September (Rehn); Washington, Olympia, August; Seattle, August; Idaho, Northwest, July (Poling).

Augiades sylvanoides form **nemorum** Boisduval

From the Oberthur figure[3] we take this to be a form of *sylvanoides*, of somewhat frequent occurrence in California, Utah and in Colorado where *sylvanoides* approaches the race *napa*,

[3] Etud. Lep. Comp., ix., plate 240, fig. 2088 (♂), (1913).



1. *Atalopedes campestris,* Round Mountain, Texas. 2. *Augiades morrisoni,* Jemez Springs, New Mexico. 3. *Augiades agricola,* Las Uvas, California. 4. *Augiades sylvanoides,* San Francisco, California. 5. *Augiades snowi,* Morrison, Colorado. 6. *Polites phylaeus,* Palm Beach, Florida.

and in which the secondaries below are light yellow and immaculate. We have a specimen which appears to exactly agree with the Oberthur figure. *Pratincola* we take to be an aberration in which the fuscous margins are extremely reduced.

Records: California, San Bernardino Mountains, July; Fredalba, August; Colorado, Glenwood Springs (Bruce); Needle Mountains, San Juan County, July; Garfield County, July (Bruce); Utah, Eureka; August (Spalding); Park City, August; City Creek Canyon, Salt Lake City, August (Skinner); Provo, July, August (Spalding).

Augiades sylvanoides race **napa** Edwards

Type locality; Empire City, Colorado (Ridings). Typical *napa* is larger than *sylvanoides*, the secondaries below are yellow with a rather broad band of a lighter color, and it is not so variable as the Californian insect.

This race may easily be confused with the western *mystic*, from which it is quite distinct genitalically. It differs, however, in the shape of the stigma, which in *mystic* has a large dark patch of scales below the streak.

Records: Colorado, Glenwood Springs, July, September; Plainview, June; Floyds Hill, August; Clear Creek, August (all Oslar); Salida, June (Bruce); Garfield County, June (Bruce).

5. **Augiades snowi** Edwards (Fig. 5.)

Godman, Biol. Cent.-Amer., Rhop., plate 93, fig. 21, (1900).

Type locality; Ute Pass, Colorado (Snow). The shape of the valve, and the aedoeagus with its four terminal processes lead us to retain this species in the genus *Augiades*.

Records: Colorado, Bear Creek, Morrison County, June (Oslar); Webster, July (Snyder); New Mexico, Jemez Springs, July (Woodgate); Beulah, August (Skinner); Arizona, Mount Graham (Morrison).

6. **Augiades yuma** Edwards

Type information, Arizona, 1 ♂, (Wheeler). We have not seen anything from Arizona that answers the description of this insect.

7. Augiades scudderi Skinner

Type locality; White River, Colorado, July. The type, a male, and a single female paratype are in the collection of the Academy of Natural Sciences of Philadelphia. Though this has been placed as a synonym of *yuma*, attention is called to the fact that *yuma* is described as immaculate above, while *scudderi* has some faint apical and subapical spots. This species is very much like *Pamphila otto* except in the shape of the stigma, this character indicating that Lindsey has correctly placed it in the genus *Augiades*.

8. Polites phylaeus Drury (Fig. 6.)

Scudder, Butterflies Eastern U. S., plate 37, fig. 13, (1889).
Godman, Biol. Cent.-Amer., Rhop., plate 93, fig. 8, (1900).

Type information; Antigua, St. Christophers, Nevis.

We include this species in the genus *Polites*. It bears a close resemblance to *vibex* and the male genitalia are similar in the shape of the end of the valve, and the terminals of the uncus, which in this species, and almost all of the other species of the genus *Polites*, are provided with a peculiar stout beak, made up of a bundle of fused hooks.

Records: Florida, Miami, January (Porter); St. Petersburg, January (Williams); Georgiana; St. Augustine; Georgia, Tifton; Mississippi, Agricultural College, September (Weed); Alabama, Mobile, September (Dukes); Tennessee, Nashville, August; North Carolina, Southern Pines, November (Mance); Cranberry, September (Thomas); Wilmington, June, July; Illinois, Quincy, October (Poling); Nebraska, Omaha, September (Leussler); Texas, San Antonio, June (Poling); Corpus Christi (Aaron); Tiger Mill, April; Round Mountain, July; Chisos Mountains, July (Wenzel); Arizona, Florence, August, September, (Bonniwell); California, Los Angeles, June, July, September; Pasadena; Cuba; Jamaica, Bath; Santo Domingo; Antigua, English Harbour; Martinique, St. Pierre; Colombia [New Grenada]; Mexico, Colima; Sonora; Texola; Dutch Guiana, Paramaribo; Venezuela, Buelta Triste; Brazil, Chapada; Paraguay, Sapucay; Villa Rica.

9. **Polites vibex** Geyer

Godman, Biol. Cent.-Amer., Rhop., plate 93, fig. 14, (1900).

Type information, Antilles. A widely distributed species from the Mexican border south through South America.

Stigma Skinner, from Corpus Christi, Texas (Aaron), the type, a male, and a male paratype in the collection of the Academy of Natural Sciences of Philadelphia, may be placed as a synonym of *vibex*. It is very like Mexican specimens and represents the typical form crossing the border.

Records: Mexico, Colima; Vera Cruz, February (Williams); Guatemala, Quirigua (Rhoads); Puerto Barrios; Ecuador, Huigra, May (Rhoads); Panama, Gatun, Canal Zone, July (Harrower); Dutch Guiana, Paramaribo; Brazil, Chapada; Paraguay, Sapucay.

Polites vibex form **brettus** Boisduval (Fig. 7.)

Scudder, Butterflies Eastern U. S., plate 37, fig. 27, (1889).

Type information, Georgia. This is the usual form occurring in the southern and southeastern portion of the United States. The stigma appears to be smaller because the patch of scales around it are more abbreviated, there is more fulvous above, especially on the primaries, and the spots below are larger and deeper in color, sometimes coalescent forming patches, while in typical *vibex* they tend to be more discrete or obsolescent.

Records: Georgia, Thomasville, March (Hebard); Florida, Key West (Morrison); Miami, February (Williams); Venice (Bonniwell); Georgiana; St. Petersburg; Sanford; Gulfport, June (Reynolds); Alabama, Mobile, April (Dukes).

Polites vibex form **brettoides** Edwards

Type information; Western Texas (Boll), Mount Graham, Arizona (Morrison). This is a form in which the bright fulvous areas are extended to cover almost the entire surfaces, especially on the primaries, leaving a narrow margin of fuscous. The spots below, however, are heavy as in *brettus*. The females of all the forms are dark fuscous above with whitish maculation, the secondaries below have a darker, more olivaceous, ground color, the spots following the pattern of the male, and showing corresponding variation. The male genitalia of all three forms seem to be identical.

Records: Texas, Corpus Christi (Aaron), San Antonio.

10. **Polites sabuleti** Boisduval (Fig. 8.)

Type information, California. *Chusca* Edwards was described from a single male from Arizona (Wheeler Expedition). The type is a very much rubbed specimen, the "immaculate" secondaries below may well have become so by wear, and we believe the name should fall to *sabuleti*.

Records: California, San Francisco, July, August, September (Hueguenin); Mojave Desert; Oakland, September; Marin County, April (Hueguenin); Palm Springs, September (Coolidge); Truckee, July, August; Riverside, March; Santa Monica, July; Round Valley, Inyo County, October; Arizona, Gadsden (Schiffel).

Polites sabuleti form **tecumseh** Grinnell

Type locality; Little Crabtree Meadow near Mount Whitney, California. The type locality of *chispa* Wright is the Sierra Nevadas of Central California, June, July, 6,000 to 8,000 feet elevation. We take *tecumseh* to be a small mountain form of *sabuleti* in which the fuscous areas above are more extended with the consequent restriction of the fulvous.

Records: California, Yosemite Valley, May (Cresson); Summit, September; Deer Park, Placer County, June; Oregon, Fort Klamath.

11. **Polites draco** Edwards (Fig. 9.)

Type information, Colorado (Mead).

The male genitalia of *draco* are very similar to those of *sabuleti*, there is, however, a slight difference in the shape of the terminal appendages of the aedoeagus.

Records: Colorado, Wilson Peak, August; Hall Valley, July; Plainview, June (all Oslar); Park County, 12,000 feet elevation, July (Bruce); New Mexico, Jemez Mountains, June (Woodgate); Top of Las Vegas Range, June.

12. **Polites sonora** Scudder (Fig. 10.)

Type locality; Sierra Nevada, California. Typical *sonora* has the ground color of the secondaries below, yellow ocher, with paler yellow spots.

The aedoeagus terminates in two lobes like petals, the outer surface strongly dentate, and there is a floating object shaped

somewhat like an axe with a serrate edge. A similar object appears in the aedoeagus of *manataaqua*.

We follow the literature in giving *sonora* specific rank, though it may prove to be a western form of *mystic*. We can find no characters in the male genitalia by which they may be separated, but *sonora* is smaller in size than *mystic*, and the spots on the secondaries below are smaller and often round, while in *mystic* they are elongated, often fused, and they occupy a relatively larger area of the wing.

Records: CALIFORNIA, San Bernardino, August (Wright); Truckee, July (Dodge); Round Valley, Inyo County, October (Poling); Yosemite, July (Dodge); Yreka, Siskiyou County, June (Fox); Upper Soda Springs, Siskiyou County, June (Fox); Bridgeport, July; Fredalba, July (Braun); OREGON, Fort Klamath, June; WASHINGTON, Seattle; NEVADA, Western (Denton); COLORADO, Kenosha Pass, August (Oslar).

Polites sonora form **siris** Edwards

Type locality originally given as Mount Hood, Oregon, but later corrected to Puget Sound, Washington.

We quote from the original description, "Under side of . . . secondaries brown, still more (than the primaries) dusted with fulvous scales, a yellow row of spots on disc . . . and a long spot in cell. Female, under side deeper fulvous, almost cinnamon." We have specimens from Olympia, Washington, July, and from Castella, Shasta County, California, June (Fox), in which the secondaries below are unusually dark brown with the "cinnamon" tone referred to above, and which run fairly true to color in the series. We therefore retain this name *siris* as a color form. It also has the fulvous more restricted above, on the secondaries usually reduced to a row of fulvous spots.

Polites sonora form **utahensis** Skinner

The male type and a female paratype from Park City, Utah (Snyder), are in the collection of the Academy of Natural Sciences of Philadelphia. This form has the ground color of the secondaries below, green, the spots are white and in the type larger than the corresponding spots in typical *sonora*.

Records: UTAH, Ogden, July; COLORADO, San Miguel, August (Oslar); Hall Valley, July (Oslar); Pike's Peak, August; Grizzly

Mountain, Garfield County, 8,000 feet elevation, July (Bruce); New Mexico, Beulah, August (Skinner); Idaho, Beaver Canyon, June, July, (Snyder); Wyoming, Evanston, August (Skinner).

13. **Polites mystic** Scudder

Scudder, Butterflies Eastern U. S., plate 37, fig. 31, (1889).

Type information, White Mountains (of New Hampshire) to Maryland.

The male genitalia seem to be the same as those of *sonora*.

Records: Connecticut, Avon, June (Williams); Vermont, Royalston, July (Scudder); New York, Liberty, June; Axton, Adirondack Mountains, June; Pennsylvania, Pittsburgh, May; Elwyn; Iron Hill, August; Ricketts, June; Harvey's Lake, June. (all Skinner); Poyntella, June (Calvert); Michigan, Pequaming, July (Hebard); Ontario, Nepigon, July (Skinner); Manitoba, Husavick, July (Wallis), Beulah, July (Dennis).

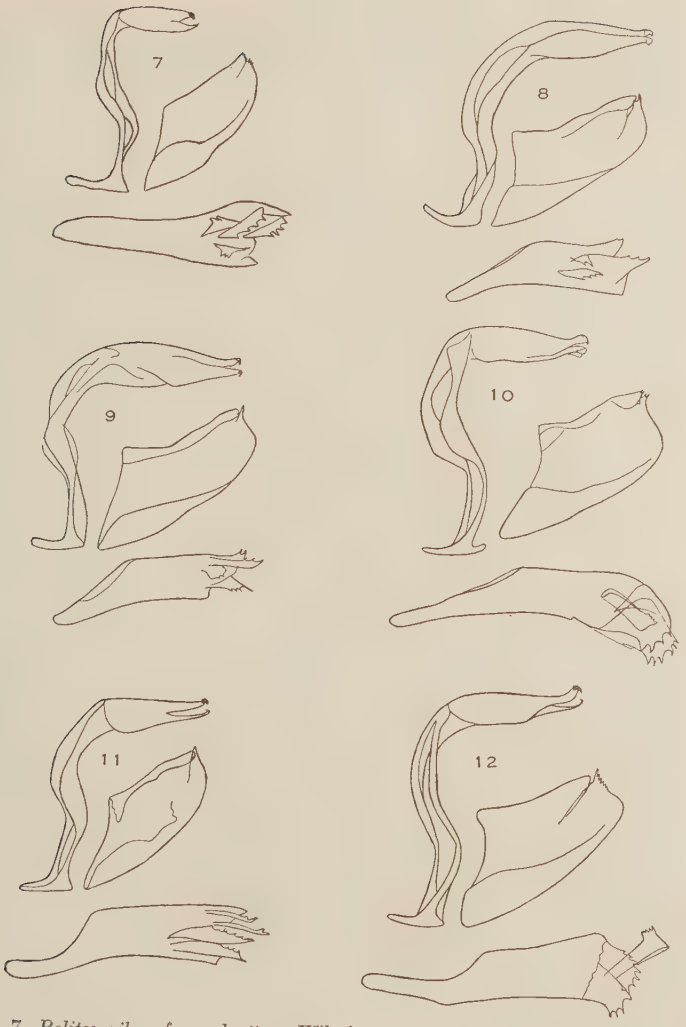
Polites mystic race **dacotah** Edwards

Type information, Colorado (Mead).

The male type, and a female paratype of *pallida* Skinner, from Volga, South Dakota, July (Truman), are in the collection of the Academy of Natural Sciences of Philadelphia. Edwards placed *dacotah* as a synonym of *napa*. Barnes and McDunnough[4] have located the type and consider it the western race of *mystic*, sinking *pallida*. We are adopting this nomenclature with the suggestion that an examination of the male genitalia of *dacotah* would definitely settle the matter. This form has the fuscous areas of the wings above more restricted, and below, the secondaries are much lighter yellow with the band consequently less prominent. The male genitalia of *pallida* are the same as those of *mystic*.

Records: Colorado, Berkeley, June; Denver, June; Mill Gulch, May, June; Clear Creek, June (all Oslar); South Dakota, Volga, June, July (Truman); Iowa, Grinnell, June; Ohio, Tiffin, July (Ullrich).

[4] Cont. Nat. Hist. Lep. N. A., III, p. 131, (1916).



7. *Polites vibex* form *brettus*, Wilmington, North Carolina. 8. *Polites sabuleti*, Santa Cruz, California. 9. *Polites draco*, Wish Steppes, Colorado. 10. *Polites sonora*, Round Valley, Inyo County, California. 11. *Polites taumas*, Nepigon, Ontario. 12. *Polites manataaqua*, Philadelphia, Pennsylvania.

14. **Polites taumas** Fabricius (Fig. 11.)

Scudder, Butterflies Eastern U. S., plate 37, fig. 16, (1889).

Type information, North America. Butler[5] figures *taumas*, the male, and *phocion*, the female, which we accept as typical of the Fabrician species. *Cernes* Boisduval and LeConte should fall to it.

Records: Connecticut, Avon, July (Williams); New York, Albany, July (Bailey); New Jersey, Gloucester, May (Williams); Pennsylvania, Philadelphia, May, August (Skinner); North Carolina, Cranberry; Wilmington, June; Georgia, Tifton, May; Florida, Seven Oaks; Gulfport, June (Reynolds); Dunedin, March; Missouri, Creve Canyon (Schwarz); Arkansas, Hope, June, July, August (Knobel); Tennessee, Nashville, July, August; Illinois, Quincy, May, June (Poling); Nebraska, Omaha, May (Leussler); Cedar Bluffs, May (Leussler); South Dakota, Volga (Truman); Colorado, Clear Creek, June (Oslar); Plainview, June (Oslar); Utah, Vineyard, June (Spalding); Park City, July (Snyder); New Mexico, Jemez Springs, June (Woodgate); Cloudcroft, June (Viereck); Ontario, Nepigon, July (Skinner); Toronto.

15. **Polites manataaqua** Scudder (Fig. 12.)

Scudder, Butterflies Eastern U. S., plate 37, fig. 28, (1889).

Type information, Massachusetts. Fresh specimens of the males of *manataaqua* may be distinguished from *taumas* by the fulvous area of the primaries above, which in *manataaqua* has a coppery, metallic sheen and is often obsolescent or obsolete. The females are darker above and usually lack the fulvous area on the primaries, present in the female *taumas*.

Manataaqua differs genitalically from *taumas* in the shape of the terminal projections of the aedoeagus, as shown by our figures, that of *manataaqua* being provided with serrated lobes, and a floating object very like this organ in *sonora*.

Records: Pennsylvania, Philadelphia, August, September (Aaron); Pittsburgh, June; New York, Albany (Bailey); New Jersey, Clementon, August (Laurent); Elizabeth; District of Columbia, Washington, August; North Carolina, Wilmington,

[5] Cat. Fab. Diur. Lep. Brit. Mus., p. 227, plate 2, fig. 14, plate 3, fig. 9, (1869).

May, June; GEORGIA, Tifton, May, September; ALABAMA, Spring Hill, Mobile County, May, September (Dukes); ARKANSAS, Hope, July (Knobel); IOWA, Sioux City, July; TENNESSEE, Hale Springs, June.

Polites manataaqua race **rhena** Edwards

Type information, South Colorado (Morrison). The type of *alcina* Skinner, a male, and two female paratypes from Platte Canyon, Colorado (Bruce), are in the collection of the Academy of Natural Sciences of Philadelphia. The long sinuous stigma of *rhena*, similar in *alcina*, leads us to accept the Lindsey nomenclature.

This western race is larger and the males have a larger area of metallic fulvous on the primaries above and there is usually some on the secondaries also.

The male genitalia are the same as those of typical *manataaqua*.

Records: COLORADO, Clear Creek, June, July (Oslar); Plainview, June (Oslar); NEW MEXICO, Beulah, June (Skinner).

16. **Polites peckius** Kirby (Fig. 13.)

Scudder, Butterflies Eastern U. S., plate 37, figs. 24, 25, (1889).

Type information; latitude 54, North America (Peck).

Records: ONTARIO, Fort William, August (Williams); MANITOBA, Beulah (Dennis); NEW HAMPSHIRE, Franconia, White Mountains (Slosson); CONNECTICUT, Avon, May, June (Williams); RHODE ISLAND, Johnston, May; NEW YORK, Axton, Adirondack Mountains, June; NEW JERSEY, Gloucester, May (Williams); NORTH CAROLINA, Cranberry, June, August, September (Thomas); TENNESSEE, Hale Springs, June (Thomas); ILLINOIS, Quincy, May (Poling); NEBRASKA, Nebraska City, May; Omaha, May; Wyoming, May (all Leussler); IDAHO, Priest Lake; HONDURAS; San Pedro.

17. **Polites mardon** Edwards (Fig. 14.)

The type information is Mount Hood, Oregon (Morrison ?). The stigma of the male is shorter and more sinuate than that of *peckius;* the primaries are more rounded on their outer margin; the fuscous areas are more restricted and blend into a darker fulvous area; below the wings are lighter and with less contrasting coloration, the bands on the secondaries being only

slightly darker than the ground color and not so clearly defined as in *peckius*. We have males only, from Olympia, Washington, May. The male genitalia are very close to those of *peckius* but not identical.

18. **Polites baracoa** Lucas (Fig. 15.)

Type information, Cuba.

This insect has a rather thin stigma, not so sinuous as that of *peckius*. It is much darker, the secondaries being extremely fuscous above, and dark brown below with a band of lighter spots just indicated. The terminals of the uncus are split and end in two sharp points, but do not have the bundle of small hooks characteristic of all of the preceding species of the genus *Polites*. The aedoeagus carries two strong smooth projections, and two additional floating objects.

Records: CUBA, Havana, January (Williams); Guantanamo, August (Ramsden); FLORIDA, Central (Morrison); Key West (Morrison).

19. **Polites verna** Edwards (Fig. 16.)

Scudder, Butterflies Eastern U. S., plate 37, fig. 34, (1889).

Type information: "Illinois, from Mr. Walsh, Washington."

We follow Lindsey in placing *verna* tentatively in the genus *Polites*, although the entire structure of the male genitalia is quite different from that of the other species of this genus. In some respects the genitalic characters would bring it into *Atrytonopsis*, but there may be some Central or South American genus with which it may be more properly associated.

Records: CONNECTICUT, Avon, June, July (Williams); RHODE ISLAND, Elmwood, July; PENNSYLVANIA, Philadelphia, June, (Skinner); Pittsburgh, June; DISTRICT OF COLUMBIA, Washington, August; ILLINOIS, Quincy, June (Poling); TENNESSEE, Nashville, July; NORTH CAROLINA, Cranberry, August (Thomas).

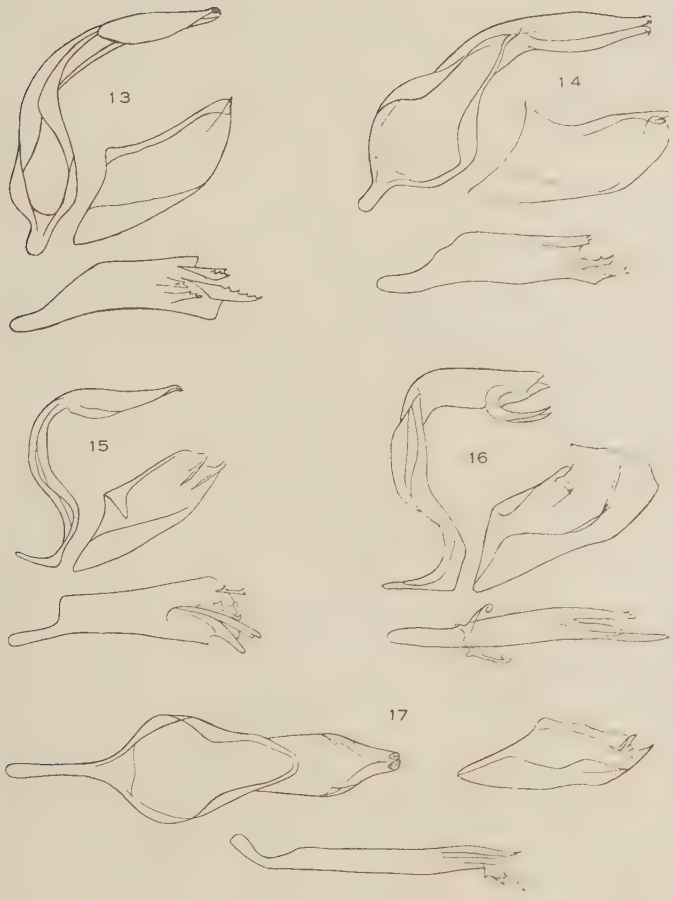
20. **Catia otho** Abbott and Smith (Fig. 17.)

Scudder, Butterflies Eastern U. S., plate 37, fig. 15, (1889) (as *Thymelicus aetna*).

Godman, Biol. Cent.-Amer., Rhop., plate 93, fig. 18, (as *Catia dearei*).

Type information, North America, (Georgia).

In the Southern States, to which we confine the type name *otho*, there is more orange or rufous on the wings both above and



13. *Polites peckius*, Pequaming, Michigan. 14. *Polites mardon*, Olympia, Washington. 15. *Polites baracoa*, Florida. 16. *Polites verna*, Ohio. 17. *Catia otho*, San Antonio, Texas.

especially on the secondaries below. The northern race is darker and the color infusing the basic fuscous is olivaceous.

The male genitalia of *otho* are very like those of the genus *Polites*, the terminals of the uncus being provided with the terminal hooks characteristic of most of the species of that genus.

Hesperia drury Latreille,[6] from the Antilles, is specifically the same as *otho*, but we believe the name should be retained as a racial form, distinguished by having a more orange color than *otho*, and relatively as important as *egeremet*. This form does not appear in our fauna.

Records: FLORIDA, Miami, January, February, March (Williams); Key West, May (Morrison); Sanford, August; Gulfport, May (Reynolds); Georgiana, May; Biscayne Bay (Slosson); NORTH CAROLINA, Wilmington, May, June; Cranberry, July; TENNESSEE, Nashville, June; TEXAS, Round Mountain, May, June, September, October; San Antonio; Corpus Christi (Aaron).

Catia otho race **egeremet** Scudder

Type information; "♂ Mass. F. G. Sanborn; ♂ ♀ Georgia, Harris' Collection from Mr. Abbot and Dr. Oemler; ♂ Western States, Mus. Comp. Zool."

Records: CONNECTICUT, Avon, July (Williams); PENNSYLVANIA, Philadelphia, July; NEW JERSEY, Newark, July; Essex County, June; OHIO, Dayton, July; ARKANSAS, Hope, July, August (Knobel).

[6] Enc. Meth., IX, p. 767, (1823).

THE GROUP SCYLLINAE (ORTHOPTERA, ACRIDIDAE, ACRIDINAE) AS FOUND IN NORTH AMERICA, WITH RECORDS AND DATA ON ITS OCCURRENCE IN THE UNITED STATES

BY MORGAN HEBARD

Recent studies on the forms of this Group found in Panama and Colombia showed the necessity of considering all the material available of the North American species. This has resulted in the decision that but two species of the genus occur in the regions under consideration, of which one is found in the West Indies and the lowlands of Panama, Colombia and Ecuador and represents the entity to which the name *cyanipes* was applied by Fabricius.[1] The other occurs in south-central Arizona, Mexico, Honduras, Nicaragua, the highlands of Costa Rica, (probably) Panama and Colombia. This latter is one of the most difficult entities we have encountered, due to the very great variation in size, color and color pattern which it shows. Saussure's *viatoria* is the oldest name available and we divide the species into three geographic races.

Four hundred and forty-one specimens are before us, of which *cyanipes*[2] is represented by eighty-eight from the West Indies and fourteen from Panama and Colombia. We refer two hundred and twenty-two specimens to *viatoria viatoria*, nine to *viatoria excelsa* (Bruner) and one hundred and eight to *viatoria cyanomera* Hebard.[3]

Typical *viatoria* is found in south-central Arizona, over probably all Mexico except at high elevations, extending southward through Honduras and Nicaragua and into the uplands of Costa Rica and probably Panama.

We believe it advisable to recognize Bruner's *excelsa* as a race of *viatoria*, occurring on the central plateau of Mexico. In this case the differentiation from the typical form is slight. The insect averages smaller and more robust, with proportionately

[1] Described from "America."

[2] We have recently indicated the synonymy of Stål's *peragrans*, described from the Island of Puna, Ecuador; Trans. Amer. Ent. Soc., XLIX, p. 211, (1923).

[3] Described; Trans. Amer. Ent. Soc., XLIX, p. 212, (1923).

shorter organs of flight and shows color differences which may have some value. It is clearly the species' adaptation to high altitudes in Mexico. A series from Orizaba, Mexico,[4] before us is referable to *viatoria viatoria*, though in some cases showing a tendency toward *excelsa*.

The third race *viatoria cyanomera* is an inhabitant of the highlands of the Sierra Nevada de Santa Marta, Colombia, while four specimens labelled simply "Costa Rica" probably came from areas of similar environment in that country, as the insect is plainly an adaptation to a highland region in that latitude.

Individual variation in these species and races is so great that the following key is given only as an aid in studying material of the species, satisfactory determination being possible only through comparison of large series as well, since the key can give only features considered typical.

A. Vertex and frontal costa forming a broadly rounded but distinct fastigio-facial angle. Fastigium triangularly impressed in distal portion, with transverse crescentic impression mesad absent or very weak. Rectangular lateral foveolae present though very weakly impressed, with angles rounded and margins broad and bluntly rounded. (Size comparatively small and form slender. Ventral surface of caudal femora pale. Caudal tibiae pink with distal portion cyaneous.) [West Indies, Panama, Colombia, Ecuador.]. . . . . *cyanea* (Fabricius)

AA. Vertex rounding so broadly into frontal costa that a fastigio-facial angle can scarcely be said to exist. Fastigium with a weak rounded impression meso-distad, this strongest at its mesal transverse crescentic impression. Lateral foveolae practically obsolete, appearing only as a smooth broadening on each side of the frontal costa and fastigium at their juncture.

B. Ventral surface of caudal femora and distal portion of caudal tibiae never brilliant cyaneous.

C. Size small to large, form normal. Tegmina and wings not reduced. Ventral surface of caudal femora pale. Caudal tibiae (pale or pinkish buff) sometimes with distal portion faintly suffused with cyaneous. [Arizona, Mexico, Honduras, Nicaragua, Costa Rica.]. . . *viatoria viatoria* (Saussure)

CC. Size medium, form slightly more robust. Tegmina and wings showing distinct, though slight, reduction. Ventral surface of caudal femora suffused with or solidly dull blackish cyaneous. Caudal tibiae (pale or pinkish buff) sometimes with distal portion suffused with or solidly dull blackish cyaneous. [Central plateau of Mexico.] *viatoria excelsa* (Bruner)

[4] This series was determined by Bruner as *viatoria* and as *macneilli*.

BB. Ventral surface of caudal femora and distal extremity of caudal tibiae solidly brilliant cyaneous. (Size large, form normal. Tegmina and wings not reduced.) [Sierra Nevada de Santa Marta, Colombia and (probably highlands of) Costa Rica.] ..... *viatoria cyanomera* Hebard

These forms all agree in having the ventro-internal spur of the caudal tibiae slightly less than twice as long as the dorso-internal, with claw-like apex unspecialized. A high degree of color variation is found in all, but is particularly striking in the series of typical *viatoria* before us. Such variation is shown by presence or absence of green coloration, of a pale dorsal medio-longitudinal band, of a dark vertical sub-ocular bar or patch, of a large dark patch mesad on the pronotal lateral lobes, of large and regular tegminal markings, of a striking pale tegminal humeral band, of heavy dark transverse bars on the dorsal surface of the caudal femora and of heavy dark markings on its external pagina.

The following data on the synonymy of typical *viatoria*, and its occurrence in the United States, are given in order to straighten out the confusion as to how many and which species of *Scyllina* occur in this country, and where these may be found.

Scyllina viatoria viatoria (Saussure)

1861. *St[enobothrus] viatorius* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 317. [All of Mexico.]

1871. *Stenobothrus nobilis* Walker, Cat. Dermapt. Saltat. British Mus., V, suppl. p. 79. [♂, Oaxaca, Mexico.]

1901. *Plectrotettix patriae* Scudder, Proc. Davenport Acad. Nat. Sci., VIII, p. 95, pl. III, fig. 2. [♀, California?]

1904. *Plectrotettix calidus* Bruner (in part), Biol. Cent.-Amer., Orth., II, p. 101. [Type, ♂[5]; Cuernavaca, Morelos, Mexico.]

1904. *Plectrotettix macneilli* Bruner, Biol. Cent.-Amer., Orth., II, p. 102, pl. I, figs. 12, 12a and 12b. [Type, ♂[6]; Orizaba, [Vera Cruz], Mexico.]

Walker's *nobilis* has the ventral surface of the caudal femora as well as the caudal tibiae "red"[7] in the described males. We have males from Honduras and Nicaragua showing this and

[5] Selected in 1912, Hebard Collection, Type no. 261, by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 113.

[6] Here selected, Hebard Collection, Type no. 911. Taken January, 1892, by L. Bruner.

[7] Undoubtedly between light coral red and dragon's blood red.

males from Baja California, in which it is less strongly indicated. The condition does not appear worthy of even racial recognition.

Scudder's *patriae* is based on a dried alcoholic specimen which probably came from Baja California. The discoloration of the specimen led to the description of apparent but not real differences. We have examined southern California quite thoroughly and are of the opinion that the genus does not occur in that State.

Bruner's *calidus* is merely the optimum condition developed in *viatoria*, the other characters given being all wholly attributable to individual variation. His *macneilli* is a striking color phase in which the dark body markings are all larger and more regular than usual, the pale tegminal marks narrow but also unusually regular. The material on which this name was based shows some slight indication of divergence toward the race of the central plateau of Mexico, *viatoria excelsa*.

Typical *viatoria* has previously been recorded from Tucson and the Baboquivari Mountains in Pima County, and from San Bernardino Rancho, in Cochise County, Arizona, as the synonymous *Scyllina calida* (Bruner) by Rehn and by Rehn and Hebard.

The following localities are all in Pima County, Arizona, except the last, which is in Santa Cruz County, Arizona.

Tucson, X, 12, 1910, 2400 feet, (R. & H.; in dry yellow grass), 2 ♀.

Tumamoc Hill, Tucson Mountains, 2400 to 3092 feet, X, 3 and 4, 1910, (R. & H.; in yellow grass at Desert Laboratory, flew much like *Schistocerca*), 1 ♂, 1 ♀, 10 juv.

Roebles Pass, Tucson Mountains, c. 3000 feet, X, 11, 1910, (R. & H.), 1 ♀.

Palo Alto Rancho, Altar Valley, c. 3000 feet, X, 6, 1910, (R. & H.; some yellow grass and scattered mesquite), 2 ♀.

Near Espinosa Rancho, Altar Valley, c. 3200 feet, X, 9, 1910, (R. & H.; short yellow grass and mesquite plain), 2 ♂, 2 ♀.

Lower end of Sycamore Wash, Altar Valley, c. 3200 feet, X, 6 and 9, 1910, (R. & H.; moderately common in heavy cover of short yellow grass), 13 ♂, 11 ♀, 1 juv.

Sycamore Canyon, Baboquivari Mountains, c. 3700 feet, X, 6 to 9, 1910, (R. & H.; common in short yellow grass, two attracted to light at night), 16 ♂, 16 ♀, 1 juv.

Sycamore Canyon, Baboquivari Mountains, 3700 to 4200 feet, (R. & H.; common in short yellow grass on bench of canyon slopes to summit of lateral ridges), 19 ♂, 16 ♀.

Nogales, 4000–4500 feet, IX, 20, 1922, (R. & H.; scarce among scant grasses on rolling hilltops) 2 juv.

Measurements (in millimeters) of extremes

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur	Width of caudal femur
Sycamore Canyon	25.5	4.9	3.7	24	16.8	4.1
Sycamore Canyon	28.2	5.8	4.1	27.5	19.8	4.9
♀						
Sycamore Wash	34.5	6.8	5	31.8	23	5.4
Sycamore Canyon	37.1	7	5.3	35.2	25.6	6.1

All of the present series are buffy, marked with browns of varying shade. All were taken in dry yellow grasses late in the season. A single female taken July 26, 1907, at Tucson, in a tangle of green weeds, has the pale portions of head and pronotum washed with pale green. All have a decided medio-longitudinal pale band on head and pronotum, this rarely continued on the tegmina. The sub-ocular stripe and median patch on the pronotal lateral lobes varies from obsolete to strongly developed, with intensification and recession of the color pattern. The tegminal markings are usually well defined and regular (often as in the condition figured and described by Bruner as *macneilli*), sometimes these markings are decidedly broken up and with recession become very faint and are entirely obliterated distad. The dorsal surfaces of the caudal femora are usually immaculate in the females, rarely so in the males, in the remainder having three transverse brown bars apparent but individually variable in intensity. The ventral surface and ventral portion of the internal face of the caudal femora are buffy; the caudal tibiae pink fading to buffy proximad in males, buffy in females with distal portion delicately tinged with purple or pinkish.

Due to the aridity of the environment, the entire series is paler and more desiccated in appearance than the majority of the Mexican specimens of this race before us.

We believe that the distribution of *viatoria viatoria* is limited in the United States to a small area in central-southern Arizona.

EXPLANATION OF PLATE IX

Scyllina viatoria viatoria (Saussure). Specimens taken at locality of which a photograph is here shown.

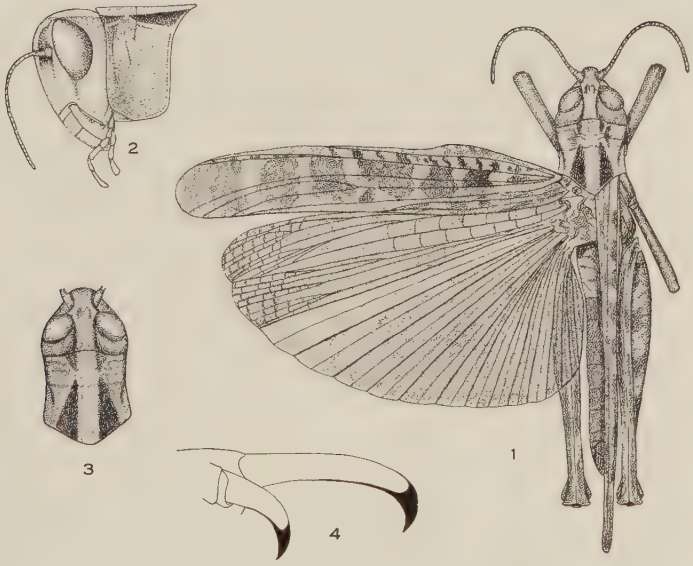
Fig. 1.—Dorsal view of male. (×2)

Fig. 2.—Lateral view of male head and pronotum. (×2½)

Fig. 3.—Dorsal view of female head and pronotum. (×2)

Fig. 4.—Lateral view of internal caudal tibial spurs of female. (Much enlarged.)

Fig. 5.—View of Sycamore Canyon from its mouth, looking westward, with Baboquivari Peak in the distance. Pima County, Arizona.



5

OBSERVATIONS AND EXPERIMENTS ON THE DISPERSION OF THE CONVERGENT LADY-BEETLE (HIPPODAMIA CONVERGENS GUÉRIN) IN CALIFORNIA

BY W. M. DAVIDSON

U. S. Bureau of Entomology, Vienna, Va.[1]

In 1917, the writer was assigned to work, in co-operation with the California Department of Agriculture, on a project embracing the natural control of injurious insects.

For many years the California Department of Agriculture has collected in the canyons of the Sierra Nevada Mountains huge quantities of the lady-beetle *Hippodamia convergens* Guérin, transported them in wire screen crates to the Imperial Valley and other places, and liberated them in the vicinity of aphid infestations.

During the seasons of 1918 and 1919, the writer was stationed in the Imperial Valley to make a study of these importations.

For the purpose of obtaining data on the distribution of the imported beetles, certain materials were used as markers. Laboratory tests with markers were made at Sacramento during the fall of 1918. It was found that beetles sprayed lightly with "silver" or "gold" aluminum paints such as are used for coating metals would retain the marks for a considerable period, and not suffer unduly through the spraying if care was taken not to hit the venter. These materials were diluted somewhat with turpentine, the "silver" paint stuck best if diluted with from one-third to one-sixth of its volume turpentine, the "gold" if very slightly, or not diluted.

In the field the practice was to dump the beetles out of the crates on to a piece of canvas in a shallow depression of the soil and advantage was taken of the habit of the beetles to right themselves immediately and pause before taking flight. A light spraying at the proper moment hit practically all of the beetles and marked visibly at least ninety per cent.

[1] Published with the permission of the Secretary of Agriculture.

In the Imperial Valley the first field test with a marker was begun on February seventeenth and eighteenth, 1919.

Some 495,000 beetles had been collected in the mountains and immediately shipped in sixty-six crates (roughly 7500 per crate) to the Valley. Examination of six crates showed that fifteen per cent. of the beetles were dead at the time of liberation. Thus, roughly speaking, 430,000 live beetles were liberated. On the first day about fifty-four per cent. of these were conveyed to a bare field, shaken out crate by crate on to a canvas cloth and sprayed with "silver" aluminum paint diluted with turpentine one-sixth of its volume (6:1). At the time of liberation the sky was clear and a gentle southerly wind was blowing and the majority of the beetles flew off towards the north at an angle of about forty-five degrees, the minority either flew straight upwards or at a low angle in all other directions. Some were liberated in sunshine, others in artificial shade; the former made off immediately, the latter more leisurely. The shade temperature was from 68 to 70 degrees F. The second day the remaining forty-six per cent. were liberated similarly. A rather strong westerly wind was blowing and the sky was partly cloudy. The shade temperature was from 64 to 66 degrees F. When released while the sun was shining the majority flew off with the wind at a low angle, the minority going in all other directions; when the sun was obscured the beetles waited until it appeared. On the twentieth only about 300 living beetles had not departed from the spot where they had been liberated.

Examination of grain fields to recover marked beetles was begun immediately after the liberation of the eighteenth. Between February eighteenth and March twelfth, fourteen fields were examined once (including a field of ploughed land), one was examined twice and two on three occasions. To the first field examined on the eighteenth, sixty minutes, but to all others one hundred minutes, time was allotted. After February twenty-fifth only four fields were visited. In all ninety beetles were collected and nineteen of these were marked. Of these latter all but two were taken on February eighteenth and nineteenth, one was found February twenty-first and the last on March first. Most of the fields of grain were heavily infested with aphids (*Aphis maidis* Fitch). The temperature at the time

of observations varied from 64 degrees F. (February 20) to 78 degrees F. (March 12). On February eighteenth and nineteenth, out of thirty-one *convergens* found seventeen were marked with the spray; from February twentieth to March twelfth, out of fifty-nine only two were marked. It might appear either that the bulk of the liberated beetles died off rapidly, or that the marks on them soon wore off, or that they undertook a second migration a few days after the first flight. Marked beetles were found in the fields nearest the point of liberation (one-half mile), and at other distances varying from one and one-half to two and one-fourth miles. Fields as far as seven and one-half miles distant were examined. Fourteen beetles were found in the northeast quarter, one in the northwest, and four due south (Fig. 1).

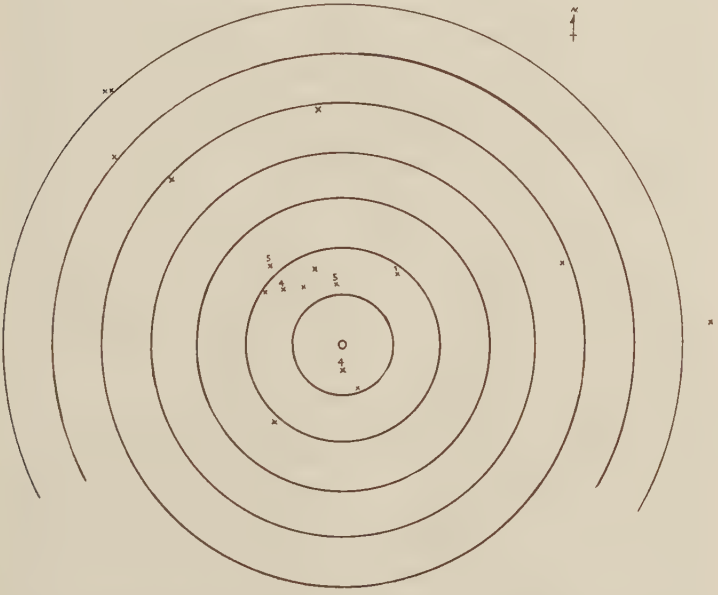


Fig. 1.—Range of distribution of *Hippodamia convergens;* circles denoting miles from liberating point 0; X indicates point of examination and figures above the number of marked beetles recovered. Wind from south and west when beetles were sprayed and liberated. Imperial Valley, California, 1919. "Silver" spray test.

Data bearing on a possible secondary flight of beetles are absent. Laboratory observations detailed below indicated that the marks are not easily erased, and do not show a pronounced mortality among sprayed beetles.

On March fifth, eleven beetles were sprayed in a manner similar to that used in the field on February seventeenth and eighteenth, and placed in a cage of one cubic foot content and enclosing infested barley plants. Eighteen untreated beetles from the same source were placed in a similar cage. On March eleventh five of the eleven treated and ten of the eighteen check beetles were dead. On March sixteenth, ten days after treatment, there were still six living beetles and but four living check beetles. These four were discarded and seventeen new beetles placed in the check cage. On March twentieth, six sprayed beetles were alive and seven out of the seventeen checks dead. On March twenty-seventh there remained alive and visibly marked five treated beetles, while but six beetles were alive in the check cage. Oviposition occurred in each cage. No undue mortality was caused by the spraying and the marks did not rub off rapidly, in the cages. These individuals were of course restrained from making free use of their elytra and wings for flight and the possibility of erasing marks on the elytra through their use in flight cannot be denied.

In the examination of fields for the recovery of marked beetles thirty-four and one-third hours were consumed. An acre of young grain plants can be carefully examined in 1.2 hours. This rate was maintained in these searches, and, therefore, the area covered was 28.6 acres.

Slightly more than three *convergens*, and less than one marked specimen were collected in an average acre. Within a radius of two and one-half miles of the liberating point there were about 160 acres of infested grain. Not all of the fields were visited. Seventeen and one-half acres were carefully examined and nineteen marked beetles found. Beyond this limit and out of a much greater acreage of grain eleven acres were searched and no marked beetles recovered.

In the first two days following the liberation, seventeen marked beetles were collected on six and one-half acres and in a little less than eight hours' search.

On March 27, 1919, a second field experiment was made. The previous day thirty-seven crates, each containing about 15,000 beetles, were supplied by the California Department of Agriculture. Since these had been kept in cold storage for several weeks, it was necessary to release them immediately upon arrival, because beetles kept in cold storage die very rapidly when exposed in crates to a sudden and prolonged rise in temperature.

Heavy aphid infestations occurred on grain at this time, and just prior to the liberation two barley fields in the vicinity of the point chosen for the release of the beetles were examined. In eighty minutes' observation not a single individual of *convergens* in any stage was noted. It appeared, therefore, that the native *convergens* were scarce and would not unduly interfere with the experiment with marked beetles.

A "gold" aluminum paint undiluted was used and the spraying performed in a manner similar to that of February seventeenth and eighteenth. Beetles in nine of the thirty-seven crates were counted and showed an average mortality of fifty-five per cent. A total of about 610,000 living beetles were liberated and sprayed. Almost all, responding to a gentle northwest wind, flew off in a south-easterly direction; the remainder headed in all other directions, but most to the south-west quarter. A few thousands remained where they were liberated. The weather conditions were clear and warm.

Between March twenty-seventh and April tenth, twenty-nine fields once, and one field twice were searched to recover marked beetles. These fields supported either barley or wheat, and the crops varied in extent of infestation by aphids. They were located from one-third to twelve miles distant from the point of liberation, the majority inside a three-mile radius. Forty minutes were spent in each examination. The total acreage of the fields in which portions were examined was 690 acres, and sixteen acres or 2.3 per cent. were carefully searched. Twenty adult *convergens* were collected, and two of these bore marks of certain identification. These two individuals were distant respectively two and three-fourths and four miles ESE from the liberation point, and were collected April first and fourth, respectively five and eight days after having been released and sprayed (Fig. 2).

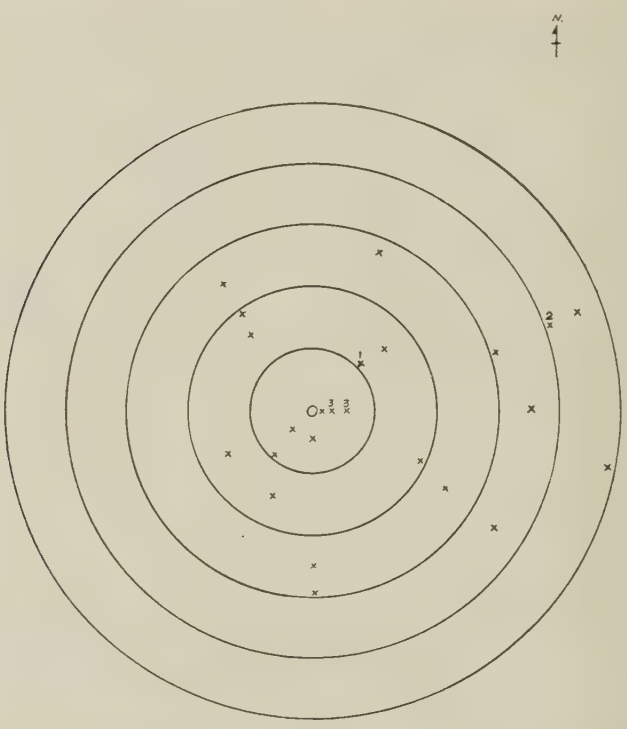


Fig. 2.—Range of distribution of *Hippodamia convergens*; circles denoting miles from liberating point 0; X indicates point of examination and figures above the number of marked beetles recovered. Wind from north-west when beetles were sprayed and liberated. Imperial Valley, California, 1919. "Gold" spray test.

As bearing on the scarcity of Hippodamia, it is of interest to note that during the search ten adults of *Olla abdominalis* Say, thirty-four of *Megilla maculata* DeGeer, and twelve of *Cycloneda rubripennis* Casey were collected.

A number of the fields visited were within two miles of the point of liberation of the beetles sprayed on February seventeenth and eighteenth with "silver" paint. No more *Hippodamia* in any stage were observed in these fields than in others much further off, and it was certain that the earlier liberation

had not visibly affected the *Hippodamia* population in them. The thirty-seven days between the two experiments was ample time for a noticeable increase in numbers, had a large number of adult beetles settled and reproduced in these fields.

As a check on the condition of the beetles utilized for the "gold" spray test laboratory experiments were made; twenty-seven sprayed individuals, nineteen of them females, were confined in vials and fed aphids from March twenty-seventh. Simultaneously, sixteen beetles from the same source, but unsprayed, were confined. Of the twenty-seven sprayed beetles, twenty-one died within three days and in eight days but two were alive; these two females were both alive on April seventeenth, and oviposited freely in the meantime. Of the sixteen checks (eight of each sex) eight males and one female were dead within three days. Four other females died within six, six, fifteen, and eighteen days; a fifth was parasitized, and the two remaining were alive after thirty days. The four unparasitized females which lived beyond six days oviposited in the vials.

The sprayed beetles succumbed more rapidly than the checks.

Another such experiment was begun in field cages on March fifth. Twenty-two beetles were removed from a crate and sprayed with undiluted "gold" paint and then placed in a wire screen cage covering barley plants infested with aphids. On the same date, eighteen beetles from the same source were placed in a similar cage for checks. Within five days seven of the sprayed and ten of the check beetles were dead; within eleven days eleven sprayed and fourteen check beetles had died. In this test the check beetles died off the more rapidly.

In reference to the rapidity of obliteration of the "gold" marks, an experiment, conducted in cages at Alhambra in 1920, showed that twenty-five per cent. of marked beetles could be recognized under a binocular microscope thirty days after they were sprayed. In this test no undue mortality resulted from the paint.

Although retention in cold storage does not in itself necessarily affect hibernating beetles unless prolonged too far, there is little doubt but that the insects liberated in March and sprayed with "gold" paint were weaker than those released in February

and sprayed with "silver" paint. The mortality at the time of liberation was much greater—fifty-two to fifteen per cent.—and among the living beetles large quantities appeared moribund, also more of them failed to migrate. This should tend to explain the failure to recover more than two certainly sprayed individuals as against nineteen such in the February test.

Some thousands of newly-sprayed beetles were killed at once and examined several months later. Ninety per cent. bore discernible markings. Thus, it is concluded that nine out of every ten flew off marked from the point of liberation.

In 1920 a third field test was made at Santa Ana, California, under somewhat different conditions. Whereas, in the Imperial Valley aphids were practically confined to grains, about Santa Ana a number of forms were prevalent. On walnut, *Chromaphis juglandicola* Kalt; on citrus, *Aphis gossypii* Glover, and on many cultivated and wild plants, *Myzus persicae* Sulz occurred. *Hippodamia convergens* was partial to the *Myzus* and the great majority of the beetles were collected on sow-thistles (*Sonchus*) infested by it and on sunflower heads growing along road-sides and about irrigation ditches. Again, the Imperial Valley is a perfectly flat, almost treeless region, whereas about Santa Ana there are many trees and the land, though flat in the main, is dotted with low hills.

Beetles collected in March by the California Department of Agriculture in the mountain canyons arrived at Santa Ana on March thirty-first. They were placed in cold storage until May seventeenth under a temperature varying from 39 to 44 degrees F. On March thirty-first it was estimated that about thirty per cent. were dead in the crates, while on May seventeenth this mortality had risen to fifty per cent. In round numbers 585,000 beetles were liberated May seventeenth and sprayed with undiluted "silver" aluminum paint in the same manner as above described. Weather conditions were calm and warm and the insects flew off in all directions. A gentle westerly wind was blowing.

To recover marked beetles search was begun May twentieth. On this day territory to the north-west of the liberation point and at a distance of one and one-half to two and one-half miles was examined. In ninety minutes' observation sixteen unmarked

convergens were collected on low herbage. The weather conditions were warm and bright. The following day territory to the south-west was searched at a distance of one-half to one and one-half miles. In one hundred and twenty minutes' observation seventy-four unmarked *convergens* were collected, all on low herbage. The weather conditions were cool and cloudy following thunder showers. On May twenty-second, land lying to the east and north-east was searched at distances varying from two hundred and fifty yards to one and one-half miles. Five hours' time was spent. At a point two hundred and fifty yards due east, two unmarked beetles were found; five hundred yards east, three marked and twenty-five unmarked beetles were collected; one thousand yards east, the beetles were abundant and out of one hundred collected three bore marks of the spray; one mile to the north-east, one marked and two unmarked beetles were taken; one and one-half miles to the north-east, two unmarked beetles were found. One hour was allotted to each of the five localities. Almost all the beetles were found on low herbage in fields or along road-sides and irrigation ditches; very few occurred in trees, notwithstanding considerable aphid infestation on walnuts. The weather conditions were bright and cool. On May twenty-fifth, after a lapse of two days, search was resumed. Territory to the east and north-east at distances from two to four and one-half miles was examined. Eighty-six beetles were collected in two and one-half hours. Two of these bore spray marks and were taken at a point four miles ENE of the point of release. All these beetles were collected on low herbage. Weather conditions were bright, warm and calm. The day following, territory to the south-east of the liberating point was examined at distances varying from one and one-half to five miles. A total of five hours in ten different localities was spent in the search and one hundred and fifty-five *convergens* were collected on low herbage, all without "silver" markings. The weather conditions were similar to those of the previous day.

After May twenty-sixth (nine days after the liberation and spraying) observations were discontinued. Marked beetles had been recovered as follows: three at a distance of five hundred yards, three at one thousand yards, one at one mile, five days

after liberation, two at a distance of four miles, eight days after liberation. All the nine individuals occurred in the north-east quarter or due east and had evidently traveled with the wind on the day they were set free (Fig. 3).

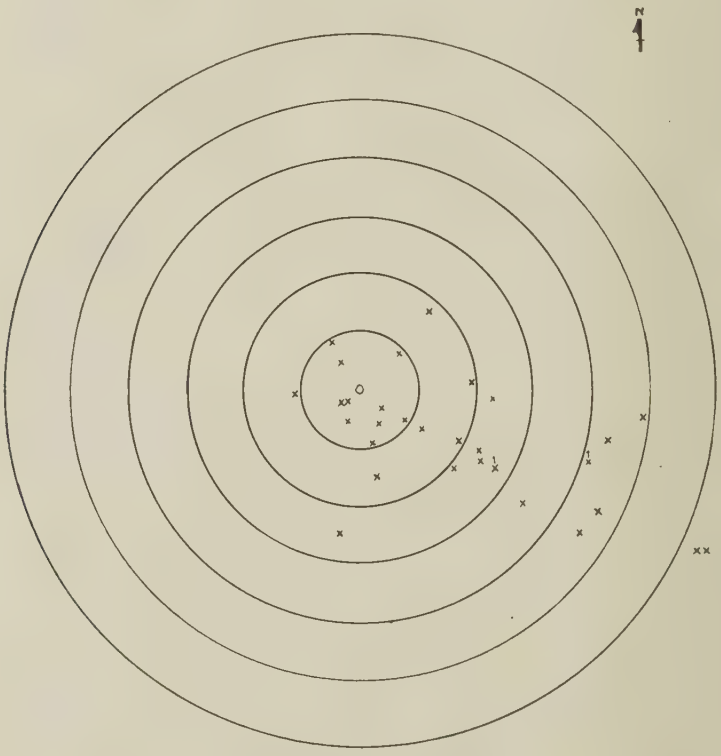


Fig. 3.—Range of distribution of *Hippodamia convergens;* circles denoting miles from liberating point 0; X indicates point of examination and figures above the number of marked beetles recovered. Wind from west when beetles were sprayed and liberated. Santa Ana, California, 1920.

H. convergens was found in about equal abundance in each of the north-east, south-east and south-west quarters, less commonly to the north-west of the liberating point. But a fraction of the whole territory within a five-mile radius was examined, and this is especially true of the farther distances. Time for the

search was spent as follows: within a radius of one mile, five and one-half hours; from one to three miles, seven hours; from seven to five miles, three and one-half hours. Within one mile seven marked beetles out of two hundred and four, from one to three miles no marked beetles out of one hundred and fifty-five, and from three to five miles, two marked beetles out of one hundred and fifteen were taken. These last two individuals, along with ten unmarked ones, were collected in a half-hour's search. This appears rather a significant fact and the more so when it is remembered that the area covered in the half-hour is about one-three-hundredths of a strip seventy yards wide about the periphery of the north-east quarter at the four-mile radius. Unless the collection of these two specimens was a fortuitous chance, it would appear that quite a number of the sprayed beetles traveled a distance of at least four miles.

One out of every 65,000 sprayed beetles was recovered.

Subsidiary tests were conducted at the laboratory at Alhambra, California, in 1920. On February twentieth, twenty-four beetles fresh from hibernating quarters were sprayed with "silver" aluminum paint and placed in vials. Twelve unsprayed individuals were used as checks. Each lot was fed with aphids. The treated beetles began to die soon, and by March tenth, three weeks after treatment, eleven had perished, while only two of the check beetles had died. On March twenty-eighth, five and a half weeks after spraying, ten out of the twenty-four sprayed and eight out of the twelve unsprayed beetles were alive, so that over the longer period the difference in mortality was less marked.

Examination of the marked individuals showed that twelve days after treatment the spray marks were visible in every case. Thereafter, a rising percentage of the beetles were found to have the marks erased until on March twenty-fourth (thirty-five days after spraying) the aluminum marks were visible on but two of the remaining eleven living beetles.

On February twenty-fifth, a hundred beetles fresh from hibernating quarters were divided into four equal lots. Three of these were sprayed with "silver" aluminum paint diluted with turpentine 4:1, the fourth lot being kept as a check. Each lot was placed in a field cage covering plants infested by aphids.

The weather remained cool for about three weeks and little activity was observed to take place in the cages. Subsequently, the temperature rose and frequent oviposition occurred. On April fourth, five and a half weeks after the beginning of the test, the beetles were removed from all cages. In the three lots of sprayed beetles there were on that date alive, respectively, nine, eight, and eleven, and in the check lot, thirteen beetles; thus, the spray apparently caused a mortality of twenty-eight per cent. On March nineteenth, twenty-three days after having been sprayed, the beetles in one cage were examined and out of the twenty living insects, seventeen were visibly marked. Ten days later there were seventeen living beetles in this cage and only five of them marked, while a week later none of the eleven remaining alive were marked.

The results of these tests indicate that the application of a paint through a light spraying caused a certain mortality, although not of an extent to seriously interfere with a dispersion experiment. It also appeared that after two weeks the specks and blotches of the paint substance rapidly became erased from the elytra and mesonotum of beetles in captivity.

Summary

The species *Hippodamia convergens* exhibits a strong gregarious tendency, congregating in great masses at suitable locations in mountain canyons, and using the same places year after year. These colonies are found chiefly in winter and break up in spring. Occasionally colonies are found in midsummer, and one such occurred in June, 1918, in the Cuyumaca Mountains in San Diego County, California.

Great quantities of hibernated *Hippodamia convergens* Guérin were liberated en masse and marked by spraying lightly with "silver" and "gold" paints, sometimes slightly diluted with turpentine. The great majority fly off strongly with the wind, a smaller number in other directions.

But a very small fraction of the treated individuals were subsequently recovered. They were found at distances varying from one-half to four and three-fourths miles from the liberation points.

Marked beetles were not recovered beyond the twelfth day after their release; the majority were taken within seven days.

When a large mass of beetles was dumped out of a crate on a piece of canvas the insects righted themselves and paused for a moment before taking wing. At this moment it was possible to lightly spray and mark ninety per cent. on the elytra and mesonotum. If the venter were hit the beetles generally died quickly.

Laboratory tests indicate that spraying the elytra resulted in a small mortality, that surviving beetles were able to feed and reproduce normally, and that the spray marks did not rub off rapidly but persisted for a period considerably exceeding the time limits of the field tests.

Conclusion

When the masses of beetles are transported to lower altitudes and released under a higher temperature in the daytime they fly off immediately and distribute themselves over large areas. When released at night the beetles migrate similarly the day following.

This migratory habit prevents the beetles from being controlled satisfactorily in restricted areas.

ON THE MALE GENITALIA OF THE HESPERIIDAE OF NORTH AMERICA

PAPER VI

BY HENRY SKINNER AND R. C. WILLIAMS, JR.

This paper will complete our studies of the male genitalia of the Hesperiidae to be found in America, north of the Mexican boundary.

In the genus *Pamphila* we follow the nomenclature given by Dr. Lindsey in his paper on the Hesperioidea[1] making only such changes in the arrangement as seem justified by the genitalic studies, and the records given are of insects in the collections of the Academy of Natural Sciences of Philadelphia and of R. C. Williams, Jr. No new names are proposed, though there are forms in both collections which cannot be positively assigned to any of the described forms, but which may later, with more material at hand and greater knowledge of the distribution and variation in this interesting group of closely allied insects, be worthy of names.

The basis of our study of the genus *Thanaos* is Skinner's paper,[2] and in this case we have not repeated the records there given, but have added those of additional specimens we have observed and, in the case of those difficult to determine from maculation, have checked up by an examination of the genitalia. The basis for our studies of the genus *Megathymus* is the Barnes and McDunnough revision.[3]

The male genitalia mounted on slides and the insects from which they have been taken, bearing labels with corresponding numbers, about twelve hundred in all, are deposited in the collection of the Academy of Natural Sciences of Philadelphia.

1. **Pamphila meskei** Edwards (Fig. 1.)

Type locality; Bastrop, Texas.

We have a male from Indian River, Florida, and Mr. E. A. Dodge sent us another Florida male from which our drawing of the genitalia is taken.

[1] Univ. of Iowa Studies in Nat. Hist., IX, no. 4, (1921).
[2] Trans. Amer. Ent. Soc., XL, (1914).
[3] Cont. Lep., I, no. 3, (1912).

The specimens referred to above are tawny yellow on the secondaries below, one of them immaculate and the other with a few obsolescent spots somewhat lighter than the ground color.

2. **Pamphila attalus** Edwards (Fig. 2.)

Scudder, Butterflies, plate 17, figs. 9 and 12, and (genitalia) plate 37, fig. 7, (1889).

Holland, Butterfly Book, plate 47, fig. 23, (1898).

Attalus was described from two females from Waco, Texas. The type information of *seminole* Scudder is "Florida to Texas," and the type is established as a female from Texas by Scudder, in his explanation of Plate 17 after figure 9: "*Erynnis attalus* ♀. Upper surface; Texas. Drawn from the type of *Ocytes seminole*," so this name cannot be used for the Florida insect. *Slossonae* Skinner was described from a male and a female collected by Mrs. Slosson at Biscayne Bay, Florida, and is not sufficiently different from the Scudder and Holland figures, or Texan material we have, to warrant the separation of the Texas and Florida insects as racially distinct.

We have some individuals in which the secondaries below are immaculate.

Records: Texas; Florida, Tarpon; Miami, January (Hebard); New Jersey, Clementon, August (Skinner).

3. **Pamphila ottoe** Edwards (Fig. 3.)

Scudder, Mem. Boston Soc. Nat. Hist., plate x, fig 6 (male), plate xi, figs. 13, 16 (clasp), (1874).

Holland, Butterfly Book, plate 46, figs. 11 (male), 12 (female), (1898).

The type information of *ottoe* is "Kansas", and of *pawnee*, Glencoe, Dodge County, Nebraska. Mr. E. A. Dodge has sent us a male of what he considers to be true *ottoe*, and from this we have made the drawing of the genitalia. It is almost entirely yellow, and immaculate above and entirely so below. Mr. Dodge states that the females are lighter than those of *pawnee* and have five obsolescent white spots on the primaries above instead of ten as in *pawnee*.

Genitalically, *ottoe*, *ogallala*, *pawnee* and *montana* seem to be identical. We agree with Mr. Leussler[4] that *ottoe* was described from a very light individual with the fuscous margins very much restricted, and that the names mentioned above all

[4] Entomological News, xxxii, p. 206, (1921).

refer to forms of the same species. According to Mr. Dodge typical *ottoe* was once common in the Nebraskan prairies.

Pamphila ottoe form **ogallala** Leussler

This we believe to be the prevailing early form in Nebraska, our examples all being labeled July. We have a male paratype from Omaha, Nebraska, and a female paratype from Valentine, Nebraska. The males are more suffused with fuscous on the primaries above and are immaculate below. The females are very light above, the fulvous predominating, and the white spots therefore less conspicuous; and there are not so many of them as in *pawnee*. These females are hardly separable from female *ottoe*.

Records: NEBRASKA, Clear Lake, Cherry County, July (Shoemaker); COLORADO (Bruce); TEXAS, Higgins, June (Dodge).

Pamphila ottoe form **pawnee** Dodge

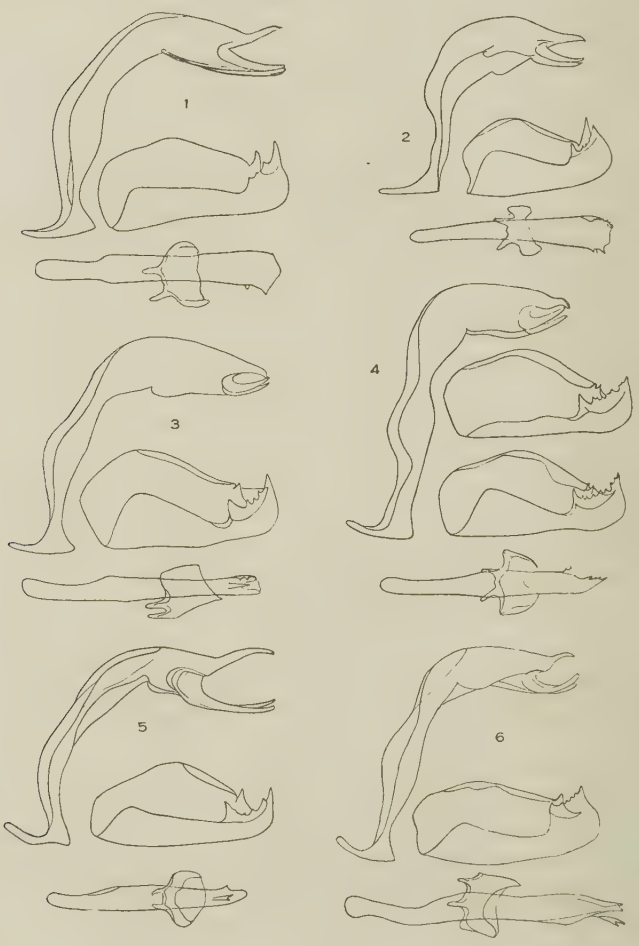
This seems to be the prevailing fall brood in Nebraska. The males are much more suffused with fuscous above and the secondaries below often show some obsolescent lighter spots. The females are suffused with fuscous, the white spots stand out conspicuously, the secondaries above show a band of whitish spots instead of the fulvous central area, and below a row of rather conspicuous round gray spots.

Records: NEBRASKA, Pilger, September (Leussler); IOWA, Grinnell (Willard); SOUTH DAKOTA, Volga (Truman); COLORADO, Bear Creek; Morrison, September (Oslar); Plainview, September (Oslar); MONTANA (Morrison).

Pamphila ottoe race **montana** Skinner

The type, a male in the collection of the Academy of Natural Sciences of Philadelphia, is from Chaffee County, Colorado, elevation 7500 feet (Bruce), together with seven male paratypes, one from Salida, 7500 feet, one from Denver, and the balance Colorado (Bruce) without further data.

This is the dark alpine form of the species, the fuscous suffusing the entire wings, leaving only the white spots on the primaries and a row of light spots on the secondaries above; and below the ground color is darker, the light spots are present in the male and conspicuous in the female.



1. *Pamphila meskei*, Florida. 2. *Pamphila attalus*, Florida. 3. *Pamphila ottoe*, Dodge County, Nebraska. 4. *Pamphila leonardus*, Havre de Grace, Maryland. 5. *Pamphila sassacus*, Avon, Connecticut. 6. *Pamphila dacotae*, Volga, South Dakota.

4. **Pamphila leonardus** Harris (Fig. 4.)

Scudder, Butterflies, plate 10, figs. 12 (female), 14 (male), plate 37, fig. 26 (genitalia), (1889).

Holland, Butterfly Book, plate 47, figs. 35 (male), 36 (female), (1898).

Comstock, How to Know the Butterflies, plate 40, figs. 7 (male), 8 (female), 9 (under side), (1904).

Type information. "New England."

Records: NEW HAMPSHIRE, Mast Yard, August; CONNECTICUT, Avon, September (Williams); NEW YORK, Catskill Mountains, August (Aaron); Crown Point, September; NEW JERSEY, Atco, September (Skinner); MARYLAND, Havre de Grace, June (Williams); NORTH CAROLINA, Cranberry, (Thomas).

5. **Pamphila sassacus** Harris (Figs. 5 and 17.)

Scudder, Mem. Boston Soc. Nat. Hist., II, plate X, figs. 5 (male), 7 (female,) plate XI, figs. 9 and 14 (genitalia), (1874).

Scudder, Butterflies, plate 10, figs. 13 (female), 16 (male), plate 37, figs. 14 and 20 (genitalia), (1889).

Holland, Butterfly Book, plate 46, fig. 13 (male), plate 47, fig. 44 (male, not *sylvanoides*), (1898).

Comstock, How to Know the Butterflies, plate 40, figs. 1 (male), 2 (female), 3 (under side), (1904).

Kellogg, Amer. Insects, plate 10, fig. 5 (male), (1905).

Type information. "Cambridge" [Massachusetts].

Records: NEW HAMPSHIRE; MASSACHUSETTS; CONNECTICUT, Avon, June, July (Williams); NEW YORK, Webster, May; Adirondack Mountains, June; Centre, June (Hill); PENNSYLVANIA, Ricketts, June (Skinner); Pittsburgh, May; NEW JERSEY, Plainfield, (Mrs. Herring); Eagle Rock, May.

Pamphila sassacus race **manitoboides** Fletcher

Type locality; Nepigon, Ontario.

The male genitalia of this insect is identical with that of *sassacus*, and we believe it to be a northern race, rather smaller, in which the fuscous areas are much more extended above, and it is darker below, causing the band of spots on the secondaries to be much more conspicuous and discrete. This relationship has been mentioned by Skinner[5] who, with Dr. Fletcher, captured a number of specimens in July, 1907, at Nepigon.

Records: ONTARIO, Nepigon, July (Skinner); Sudbury, June, July (Fletcher).

[5] Can. Ent., XL, p. 220, (1908).

6. **Pamphila dacotae** Skinner (Figs. 6 and 18.)

The type, a male from Volga, South Dakota, is in the collection of the Academy of Natural Sciences in Philadelphia, together with three male and two female paratypes from the same locality, July 28 (Truman), and one male and three female paratypes from Grinnell, Iowa, June 28 (Willard).

The split terminal of the uncus and the hooks are shorter and different in shape from those of *sassacus*, and the terminal teeth of the valve are different. We believe it to be a distinct species. It may be distinguished from *sassacus* by the fact that the fuscous border dissolves gradually into the fulvous basic color, the spot beyond the stigma so prominent in *sassacus* is obsolescent or obsolete in *dacotae*, and in general the upper side has a washed-out appearance.

The females are quite different, being entirely fuscous with just a shade of fulvous on the disc of the primaries and a band of obsolescent fulvous spots on the secondaries. The primaries have a sinuous row of whitish spots sometimes obsolescent.

We have a pair from Winnipeg, Manitoba, which are lighter and still more washed out in appearance.

7. **Pamphila harpalus** Edwards

This was described from one male and one female, labelled "Nevada, Morrison," and they probably came from the vicinity of Virginia City. Edwards states that the species is nearest *sassacus*. The description will do for some individuals of *manitoboides* or *oregonia*, and the male type in the Holland collection in the Carnegie Museum, Pittsburgh, shows it to belong in the genus *Pamphila*. The spots below are pale yellow and above it looks like *sassacus*, in fact, almost identical with it. It is probably a western race of *sassacus*, between typical *sassacus* and *manitoboides* in appearance, but we have no material from the type locality from which to study the male genitalia.

8. **Pamphila cabelus** Edwards

This also was described from three males "Nevada, Morrison." It is somewhat larger than *harpalus* and looks like it and *sassacus*, except that the markings above are obsolescent. The inferiors below are buff with a few faint almost obsolete spots, nearly of the ground color.

Edwards states it is allied to *ottoe*. We have no material for study.

9. **Pamphila uncas** Edwards (Fig. 7.)

Holland, Butterfly Book, plate 47, figs. 27 (male), 28 (female), (1898).

The type in formationis "Philadelphia." This, however, we believe to be an error, and the species is probably not found east of the Mississippi River.

Records: Colorado, Durango, June; Chimney Gulch, Golden, June; Clear Creek Canyon, June, July; Plainview, July (all Oslar); New Mexico, Jemez Mountains, June, (Woodgate); Montana, Havre; Emigrant, July; South Dakota, Volga (Truman); Saskatchewan, Rudy, July (Skinner).

Pamphila uncas form **lasus** Edwards

This we believe to be the desert form of *uncas*. The maculation is the same but it is very light, both above and below. The type information is "southern Arizona," and we have specimens collected there by Morrison which are the same genitalically as *uncas*, and also some from Fort Wingate, New Mexico, July, which may be referred to this form.

10. **Pamphila metea** Scudder (Fig. 8.)

Scudder, Butterflies, plate 10, figs. 5 (male), 11 (female), plate 37, fig. 6 (genitalia), (1889).

Holland, Butterfly Book, plate 47, figs. 33 (male), 34 (female), (1898).

Comstock, How to Know the Butterflies, plate 40, figs. 4 (male), 5 (female), 6 (under side), (1904).

Type information. "Connecticut."

Records: New Hampshire, Mast Yard; Connecticut, Avon, June (Williams); New York, Centre, May (Hill); New Jersey, Clementon, May (Skinner); Missouri; Georgia, College Park (Mills); Florida.

11. **Pamphila licinus** Edwards

The type locality is Waco, Texas.

Dr. W. J. Holland has kindly made for us a fine colored figure of the type. It is fuscous above very like *metea*, with some grayish fulvous below and around the stigma and on the disc of the secondaries, and there are some subapical whitish spots. Below it is gray with the usual whitish spots on the primaries and on the secondaries a rather connected whitish band, as in *metea*,

and a spot at base, these not very discrete. It is about the size of *metea* and appears to be closely related, or perhaps a Texan race.

12. **Pamphila comma** Linnaeus (Fig. 9.)

Scudder, Mem. Boston Soc. Nat. Hist., II, plate 10, figs. 12, 13, 14, 15 (forms of *comma*), plate 11, figs. 10, 11 (genitalia), (1874).

Reverdin, Bull. Soc. Lep. Genève, III, plate 9, figs. 6, 7 and 8 (forms of *comma*), fig. 10 (valve), plate 10, fig. 1 (genitalia), (1917).

In what we will call the *comma* group of the genus *Pamphila* there are many forms that were originally treated as varieties of the European *comma*, but of which several have been separated out as species by subsequent writers, on characters of maculation, color or genitalia. It is a group which in the process of evolution seems to be splitting up into forms or species, the exact status of which cannot be established with our present knowledge. In this paper we give specific rank to such as, with the series we have before us, can be differentiated by constant characters of maculation or of the male genitalia.

We are figuring the genitalia of such forms, names for which have already been proposed and which we are able to identify, and we are refraining from naming a number of forms which are in the collection of the Academy of Natural Sciences of Philadelphia and in that of R. C. Williams, Jr., which cannot be assigned to any of the names in use.

It has been stated that typical *comma* does not occur in America, but this is not strictly true. Every American locality in which the *comma* occurs seems to produce individuals varying considerably, and on the average different, from a similar series from Europe or Asia, but we can match up an individual *manitoba* from Manitoba with an individual *comma* from France; an individual which we would call *manitoba* from Labrador or Alaska with an individual *comma* variety *catena* from Switzerland; form *idaho* from Washington with form *pallida* from Asia Minor; Reverdin's figure of *comma* variety *apennina* is remarkably like *oregonia* and of *comma* aberration *confluа* like *columbia*.

There is a certain amount of variation in the male genitalia, of any form, as might be expected; the aedoeagus and juxta seem to be about the same in all the forms and species; the important differences are in the terminal projections of the uncus and the

shape of the terminal teeth of the valve, the differences in the uncus seeming to us to be of the most importance. The genitalic differences are not necessarily correlated with the maculation, for instance *juba* can be separated from *comma* form *colorado* on pattern but not by the male genitalia, while *columbia* is readily separated from *comma* variety *idaho* by the genitalia, but with difficulty in some individuals on maculation.

Pamphila comma form **manitoba** Scudder

Scudder, Mem. Boston Soc. Nat. Hist., II, plate 10, figs. 8 (male), 9 (female), 10 (female), 11 (male), plate 11, figs. 7, 8 (genitalia), (1874).

Scudder, Butterflies, plate 17, figs. 1 (female), 4 (male), plate 37, figs. 5, 9 (genitalia), (1889).

Holland, Butterfly Book, plate 46, figs. 2 (male, very dark, not typical), 3 (female), (1898).

Comstock, How to Know the Butterflies, plate 39, figs. 17 (male), 18 (female), 19 (under side), (1904).

Wright, Butterflies of West Coast, plate 30, fig. 421c (under side, as *colorado*), (1905).

The type is fixed by Barnes and McDunnough[6] as a male from Lahache, British Columbia. It is figure 11 of Scudder's plate, "dark brownish green below," *laurentina* Lyman sinking to it. They confine the name to a northern race extending across the continent. Color below, from dark green to dark brown, white spots discrete as in typical *comma*, seldom fused as in typical *colorado*.

The male genitalia are the same as those of the following forms of *comma:*

Records: ALBERTA, Lake Maligne, July (Schaeffer); NORTHWEST TERRITORY (Bean); ONTARIO, Fort Williams, July (Williamson); QUEBEC, Bonaventure Island, Lower Gulf St. Lawrence, September (these like typical *comma*); LABRADOR (like *catena*).

Pamphila comma form **colorado** Scudder (Figs. 10 and 19.)

Scudder, Mem. Boston Soc. Nat. Hist., II, plate 10, figs. 16 (female), 17 (female), 18 (male), plate 11, figs. 1, 2, (end of valve), (1874).

Wright, Butterflies of West Coast, plate 30, figs. 419 b (female), c (under side), (as *manitoba*), 420 c (under side), (as *nevada*), (1905).

The type is fixed by Barnes and McDunnough as a male from Colorado and figure 18 of Scudder's plate. It agrees with the description, the principal character being the continuous band

[6] Cont. Nat. Hist. Lep. N. A., III, p. 127, (1916).

of white on the secondaries below, forming a U towards the outer margin.

Individuals from high altitudes are darker green below than the type, which is described as "olivaceous or griseus green," and from this they vary to very light specimens with narrow border above and light bright yellow below, which we call variety *idaho*. The spots are usually but not always confluent as in the type. This form seems to range through the entire Western and Northwestern portion of the United States.

Records: Dark individuals, high altitudes. COLORADO, Park County, 12,000 feet, July; Silverton, July; Coal Creek Canyon, August; Rico, July (all Oslar); Summit, 14,000 feet; Gibson Gulch, 12,000 feet (Bruce).

Lighter individuals, to those near *idaho*. COLORADO; Grizzly Mountain, 12,000 feet, July; Silverton, July; Sulphur Springs, Buck Creek; UTAH, Eureka, July, August (Spalding); City Creek Canyon, near Salt Lake City, July (Skinner); Ogden, July (Spalding); MONTANA, Emigrant, July; WYOMING, Upper Geyser Basin, Yellowstone Park, August; WASHINGTON, Leavenworth; CALIFORNIA, Truckee, August, September; Buck Creek, Modoc County, 5,000 feet, July (Fox); NEW MEXICO, Beulah, August (Skinner).

Pamphila comma variety **idaho** Edwards

Wright, Butterflies of West Coast, plate 31, figs. 422, (male), b (female), c (under side), (1905).

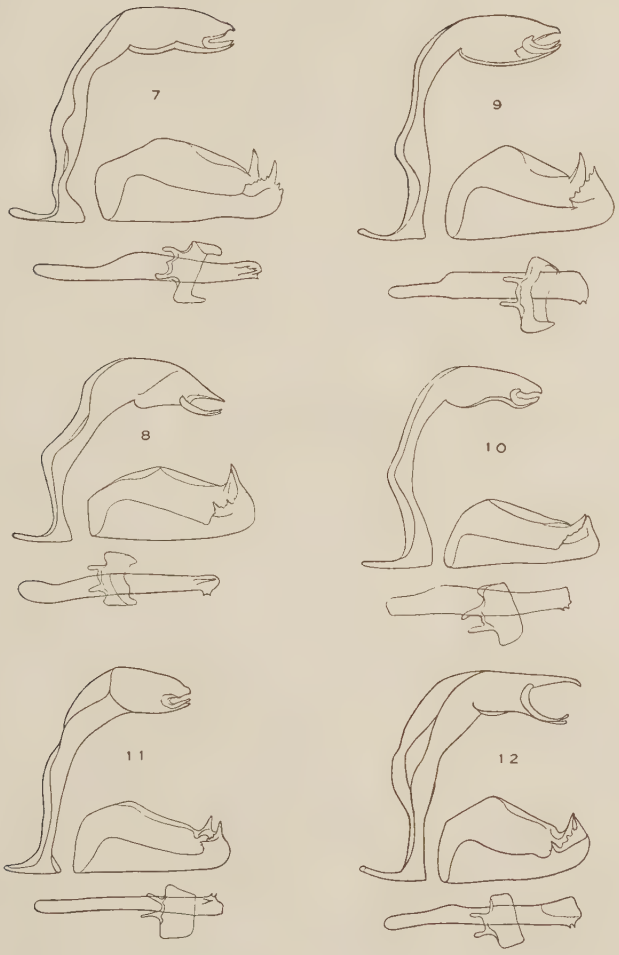
Type information: "Oregon, Washington Territory and California." The description calls for "upper side of both sexes like palest or most yellow fulvous *colorado*, under side yellow or gray-yellow, spots white as in *colorado*." It is the very light colored variety.

Records: WASHINGTON; IDAHO, Beaver Canyon, July (Snyder); CALIFORNIA, Havilah, Kern County, June; UTAH, Ogden, July.

Pamphila comma race **assiniboia** Lyman

Type locality; Regina, Assiniboia [in present day, Saskatchewan].

The under side of secondaries is described as "very pale greenish yellow." In our good series from the type locality this greenish shade is very pronounced; the spots vary in



7. *Pamphila uncas*, Durango, Colorado. 8. *Pamphila metea*, Clementon, New Jersey. 9. *Pamphila comma*, Zermatt, Switzerland. 10. *Pamphila comma*, Coal Creek Canyon, Colorado. 11. *Pamphila juba*, Oregon. 12. *Pamphila viridis*, Jemez Springs, New Mexico.

number and in color, they vary from almost white to scarcely lighter than the ground.

The male genitalia of all the forms we have placed under *comma* are the same.

Records: SASKATCHEWAN, Regina, May (Lyman); MANITOBA, Winnipeg (Roberts); Miniota, August (Gibbon); Beulah (Dennis).

13. **Pamphila juba** Scudder (Fig. 11.)

Scudder, Mem. Boston Soc. Nat. Hist., II, plate 10, figs. 19 (male), 20 (female), plate 11, figs. 5 and 6 (end of valve), (1874).

Wright, Butterflies of West Coast, plate 30, figs. 417 (male), b (female), c (under side), 418 (male), b (male, not female), c (under side), (these not *viridis*), (1905).

Oberthür, Études, IX, plate 240, fig. 2082 (male, type, as *comma* Boisduval), (1913).

As Scudder[7] gave the name *juba* to the species recorded from California as *comma* by Boisduval, and as this insect is well figured by Oberthür, we believe this California individual should be considered the type, and not the Utah specimen figured by Scudder, subsequent to his original citation. Series from California and Utah, however, are practically the same in appearance and also genitalically.

The species is close to if not a form of *comma*, but can be separated by the shape of the silvered spots on the inferiors below, or more surely by the fact that in *juba* the fuscous borders of the primaries above end abruptly against the fulvous ground, while in the allied forms the fuscous border dissolves gradually into the fulvous.

Records: CALIFORNIA, Yosemite (Lembert); Shasta; Mono Lake, Inyo County, June (Fox); Portola, April; Paper Mill Creek, September; Ben Lomond, September; UTAH, City Creek Canyon, near Salt Lake City, July (Skinner); Vineyard, June (Spalding); Eureka, May, August (Spalding); Provo, June (Spalding); Ogden Canyon, Wasatch Mountains, September (Skinner); WASHINGTON, Port Columbia, May (Hepfinger); Seattle; OREGON (Howell 1883) (these are darker and the spots on inferiors below are yellowish, not silvered).

[7] Annual Rep. Peabody Acad. Science, 1871, p. 77, (1872).

14. **Pamphila viridis** Edwards (Figs. 12 and 20.)

Lindsey, Univ. Iowa Studies, IX, plate I, fig. 12 (male), (1921).

Type locality; Las Vegas, New Mexico.

It was described as a variety of *juba* from which, however, it differs in that the fuscous border fuses into the fulvous base, and the shape of the band of spots on the secondaries below, as pointed out by Lindsey. It is quite different genitalically from *juba*, the uncus terminating in a hook, split at its apex for a short distance and the subapical arms are long. The terminal teeth of the valvae are well developed.

Records: NEW MEXICO, Jemez Springs, June (Woodgate); Fort Wingate, June; Highrolls, July (Viereck); Gila River, Socorro County, July (Gerhard); COLORADO, Plainview, June (Oslar); Clear Creek Canyon, June (Oslar); TEXAS, Ingram, April.

15. **Pamphila woodgatei** Williams (Fig. 13.)

Type locality; Jemez Springs, New Mexico, September (Woodgate).

The type, a male, and a number of paratypes of both sexes are in the collection of the Academy of Natural Sciences of Philadelphia. It may be distinguished from *viridis*, from the same locality, by the very dark ground color of the secondaries below, the spots are discrete, white, the three of the costal margin in line and the four of the outer margin also in line. The females are very much more suffused with fuscous above.

The uncus is similar to *comma* and *juba* but the two terminal teeth of the valve are more widely separated, the excavation between longer and deeper.

16. **Pamphila oregonia** Edwards (Figs. 14 and 21.)

Type information. Two males, two females, Northern California (Baron); three females, Nevada (Morrison).

We quote from the original description: "size and shape of *Colorado*, bright yellow fulvous on upper side, subapical spots not so distinct. Under side, grayish yellow, spots scarcely lighter than the ground (not white therefore or even light), band on secondaries slight, often macular, in one Nevada example altogether wanting, except for dot near outer angle."

We have specimens that agree with the above description; from Fairfax, Marin County, June (Fox), and Shasta County, July (Williams); like *idaho* but with the spots below scarcely differing in color from the ground, and these we believe to be true *oregonia*.

Genitalically, this insect differs from *comma*, being much closer to *columbia*, but it lacks the strongly developed third tooth of the valve, and the deeply excavated toothed inner lobe, by which Scudder separated out the latter species.

17. **Pamphila columbia** Scudder (Fig. 15.)

Scudder, Mem. Boston Soc. Nat. Hist., II, plate X, figs. 21 (female), 22 (male), plate XI, figs. 15 and 17 (end of valve) (as *sylvanoides*), (1874).

Wright, Butterflies of West Coast, plate 31, figs. 423 (male), b (female), c (under side), (1905).

Type information. California (H. Edwards).

The type is figured and Scudder's figure of the male genitalia is from the type specimen.

In the type, the white spots on the secondaries below, instead of being produced centrally into a U towards the outer margin, form a straight though short band across the wing almost parallel to the outer margin.

In our series, however, this band is rather variable, and in many specimens the ground color below is brighter yellow than the type. The central line of the stigma seems to be particularly conspicuous and silvery against the surrounding black velvety stigmatic scales.

There is in the collection of the Academy of Natural Sciences of Philadelphia a female paratype of *erynnoides* Dyar, the type locality of which is Monterey County, California. We believe this to be synonymous with *columbia*, and the Wright figure of the under side of *californica* resembles it.

Genitalically, the uncus is similar to that of *oregonia*, but the terminal tooth of the inner lobe of the valve is highly developed, the internal tooth of this lobe is also very strong, while the tooth of the external lobe is aborted, and it was on this character that Scudder separated it out from the forms of *comma* as a distinct species.

Records: California, Dobel, August; Ben Lomond, September; Wyoming, Old Faithful Geyser, Yellowstone Park, August (Skinner); Upper Geyser Basin.

18. **Pamphila nevada** Scudder (Figs. 16, and 22.)

Scudder, Mem. Boston Soc. Nat. Hist., II, plate X, figs. 1 (male), 2 (female), 3 (female), 4 (male), plate XI, figs. 3, 4 (genitalia), (1874).

Wright, Butterflies of West Coast, plate 30, figs. 421c (under side) (as *colorado*), (1905).

Lindsey, Univ. of Iowa Stud. Nat. Hist., IX, plate 1, fig. 9 (female), (1921).

Type locality; South Park, Colorado, June (Mead).

The secondaries above have a spotty appearance. Below they are rather dark green like the darker *manitoba*, the band is macular, the spots set in pairs, not a continuous band as in *colorado*, and they are edged with black towards the outer margin, and the margin itself has a black line that cuts into the fringes.

It is readily separated from *colorado* by the male genitalia. The terminal processes of the uncus are very long. The external teeth of both lobes of the valve are well developed, the interior one being particularly long and hooked or bent backwards towards the abdomen.

Records: COLORADO, Jamestown, July; Bear Creek; Morrison, August; Rico, July (all Oslar); MANITOBA, Miniota, August (Gibbon); SASKATCHEWAN, Fort Qu'Appelle.

19. **Pamphila ? ruricola** Boisduval

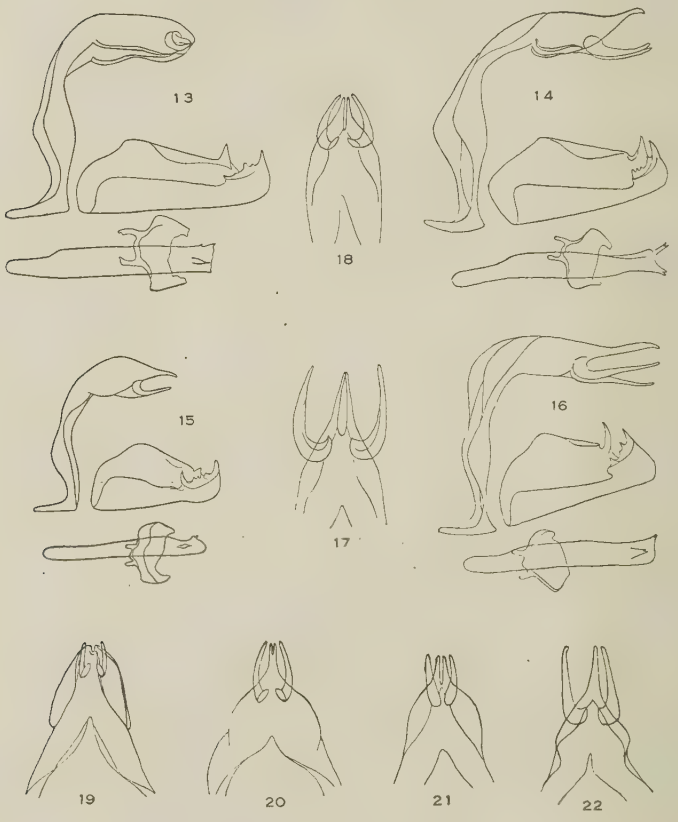
Oberthür[8] states that in his Boisduval collection it is "missing—type seems lost."

We give a free translation of the original description as follows:

"Size and shape of *lineola;* the wings a little more sinuate, nearly of the same yellow, with a narrow shaded brown border; the superiors having the discal bar as decided as in *sylvanus*, marked longitudinally by a narrow whitish line. The under side of the wings yellow with the entire surface of the inferiors and the summit of the superiors a little more tinged with green than in *sylvanus*. We have not seen the female."

We cannot assign this name to anything in our series of the *comma* group. It may not be a *Pamphila* at all, though the reference to the stigma would indicate it. There is no mention made of spots on the under surface of the secondaries, and this is puzzling as the spots in *sylvanus* are quite different in their relative locations from those of the genus *Pamphila*.

[8] Étud. Lep. Comp., IX, p. 43, (1913).



13. *Pamphila woodgatei*, Jemez Springs, New Mexico. 14. *Pamphila oregonia*, Marin County, California. 15. *Pamphila columbia*, California. 16. *Pamphila nevada*, Colorado. 17. *Pamphila sassacus*. 18. *Pamphila dacotae*. 19. *Pamphila comma colorado*. 20. *Pamphila viridis*. 21. *Pamphila oregonia*. 22. *Pamphila nevada*.

It may be an aberrant *columbia* or *oregonia*, with very dark green under side and immaculate secondaries. Perhaps one of the Californian collectors will turn up such an insect in the territory covered by Lorquin on his collecting journey.

20. **Pamphila ? californica** Mabille[9]

Type information. One male from California.

We give a free translation of the original description as follows:

"Wings brownish, mixed with fulvous near the costa, with a thick oblique fuscous streak; end of cellule fuscous; fringe grayish. Wings beneath ochraceous.

"This species greatly resembles *P. linea* of Europe. Superiors brown, with bright fulvous spots on the costa and around a thick black streak running obliquely from the extremity of the cellule to the inner border.

"The end of cellule is somewhat darker brown. Beneath, superiors ochraceous, with the middle of the disk brighter and the streak faintly reproduced. Inferiors ochraceous, one or two pale yellow dots faintly seen between the nervules. Under side of body yellow like the wings."

This species is difficult, to make out from the above description. The type, however, is probably in the collection of Mr. Charles Oberthür of Rennes, France.

21. **Pamphila ? horus** Edwards

Type locality; Dallas, Texas.

We have seen the unique type, a female, in the collection of the Museum of Comparative Anatomy at Cambridge, Massachusetts. It is immaculate above and below, fuscous, with dark gray fringes. The antennae are short with a thick club and aborted apicules as in the genus *Pamphila*. Its status cannot be determined, however, until more material is available.

22. **Thanaos icelus** Scudder and Burgess

Scudder and Burgess, Proc. Boston Soc. Nat. Hist., XIII, fig. 3 (uncus and valve), (1870).

Lintner, Ent. Cont. N. Y. State Cabinet Nat. Hist., plate 7, figs. 5, 6 (male), (1872).

Scudder, Butterflies, plate 9, fig. 6, plate 36, figs. 30, 31, 32 (genitalia), (1889).

Holland, Butterfly Book, plate 48, fig. 17 (male), (1898).

Comstock, How to Know the Butterfly, plate 45, fig. 1 (male), (1904).

[9] Bull. Comptes-Rendus, Soc. Ent. Belg., p. LXVIII, (1883).

Skinner, Trans. Am. Ent. Soc., XL, p. 200 (valvae), (1914).
Lindsey, Univ. of Iowa Studies, IX, plate 2, fig. 1 (valvae), (1921).

The male genitalia are well figured by Scudder. The spines on the scaphium giving a strawberry-like appearance to this organ serve to distinguish it from its nearest ally *brizo*, in which species these are replaced by fine hairs.

Additional Records: CONNECTICUT, Avon, June (Williams); MASSACHUSETTS, Framingham, May (Frost); PENNSYLVANIA, Pittsburgh, May; COLORADO, Platt Canyon, June (Oslar); Durango, May (Oslar); NEW MEXICO, Jemez Mountains, April, May (Woodgate); NEVADA, Western part (Denton); CALIFORNIA, Yosemite (Dyar); BRITISH COLUMBIA; SASKATCHEWAN, Fort Qu'Appelle; MANITOBA, Miniota, May (Gibbon); NOVA SCOTIA, Halifax, May.

23. **Thanaos brizo** Boisduval and Leconte

Boisduval and Leconte, Lep. Am. Sept., plate 66, (1833).
Scudder and Burgess, Proc. Boston Soc. Nat. Hist., XIII, fig. 4 (uncus, valve and details), (1870).
Lintner, Ent. Cont. N. Y. State Cabinet Nat. Hist., plate 7, figs. 9, 10 (female), (1872).
Scudder, Butterflies, III, plate 9, figs. 3 and 9, plate 36, figs. 7, 8, 9, 10, 11, 12 (genitalia), (1889).
Holland, Butterfly Book, plate 45, fig. 7 (female), (1898).
Comstock, How to Know the Butterfly, plate 45, fig. 2 (female), (1904).
Skinner, Trans. Am. Ent. Soc., XL, p. 201 (valvae), (1914).
Lindsey, Univ. of Iowa Studies, IX, plate 2, fig. 2 (valvae), (1921).

The male genitalia are well figured by Scudder. We are unable to separate *brizo* from *burgessi* on characters other than the male genitalia. In *brizo* the toothed projection of the left valve is long and slender, and that of the right valve short and wide, while in *burgessi* the two valvae end in short broad projections, they are almost symmetrical, and the teeth are stronger.

Additional Records: CONNECTICUT, Avon, May (Williams); RHODE ISLAND, Cumberland Mills, May; PENNSYLVANIA, Philadelphia, September; Pittsburgh, May; ILLINOIS; Quincy, April (Poling); NORTH CAROLINA, Wilmington, April (Saunders); TEXAS, Cypress Mill, April; MANITOBA, Miniota, May (Gibbon).

Note: The individuals recorded[10] from Durango, Colorado; Stockton, Utah, and Silver City, New Mexico turn out, upon an examination of the male genitalia, to be *burgessi* and not *brizo*.

[10] Skinner, Trans. Amer. Ent. Soc., XL, p. 201, (1914).

Thanaos brizo race **somnus** Lintner

Holland, Butterfly Book, plate 48, fig. 2 (male), (1898).

This is the Florida and southern Georgia race in which the males are darker and more discretely marked, and the bands on the females are more conspicuous, the brown being darker and the gray being lighter, showing greater contrast than in typical *brizo*. The male genitalia show some variation from type in that the projection on the left valve is longer and that of the right valve shorter.

Additional Records: Florida, Dunedin, March, April (Blatchley); Tampa, February (Easton); Melbourne (Laurent); Daytona, March; Stuart, February.

24. **Thanaos burgessi** Skinner

Skinner, Trans. Am. Ent. Soc., xl, p. 203 (valvae), (1914).
Lindsey, Univ. of Iowa Stud., ix, plate 2, fig. 3 (valvae), (1921).

The uncus and the aedoeagus of this species are the same as those of *brizo*, the distinguishing feature being the shape of the valvae.

Additional Record: New Mexico, Jemez Mountains, April (Woodgate). The specimens from Utah, Mexico, and Colorado tentatively placed here by Skinner[11] are *burgessi*.

25. **Thanaos callidus** Grinnell

Grinnell, Ent. News, xv, p. 115, figs. 1, 2, 3, (1904), (probably represent the genitalia of *lilius*).
Wright, Butterflies of West Coast, plate 32, figs. 480, 480a (males as *lacustra*), (1905).
Lindsey, Univ. of Iowa Stud., ix, plate 2, fig. 4 (valvae, as *lacustra*), (1921).

Grinnell[12] described this species from five insects from Mount Wilson, Sierra Madre Mountains, Los Angeles County, California, June 6, elevation 5886 feet. There were at least two and perhaps three species in this lot. The first mentioned, however, was described as a female, but was in reality a male, and the same species was subsequently described and figured by Wright[13] as *lacustra*. This insect should be considered the type, notwithstanding the fact that Grinnell dissected the male genitalia

[11] Trans. Amer. Ent. Soc., xl, p. 201, (1914).
[12] Grinnell, Ent. News, xv, p. 114, (1904).
[13] Wright, Butterflies of West Coast, p. 253, pl. xxxii, figs. 480, 480a, (1905).

from one of the other insects and figured portions of it with the descriptions. He states that the slide "is preserved with the type in the California Academy of Sciences," indicating to us that the type was not intended to be the male from which the genitalia was taken. This contention is confirmed by Dyar who states[14] "Grinnell has sent me the type of [*callidus*] which I find to be a rather small narrowly marked *brizo* with dark ground color." This action on the part of Grinnell as recorded by Dyar seems to definitely fix the type of *callidus*.

The original description appeared in April, 1904. In June, 1904, Dyar described[15] under the name *lilius* an insect which we believe to be conspecific with that from which Grinnell had made his slide of the genitalia, and this name, too, we believe should hold as will be discussed later.

Lacustra Wright falls to *callidus*. The insect is close to *burgessi* and both may be but western forms of *brizo*.

The valvae are according to Lindsey more rounded at the terminals than *burgessi* and without the short projections of *burgessi*, more prominent and asymmetrical in *brizo*.

26. **Thanaos martialis** Scudder

Scudder and Burgess, Proc. Boston Soc. Nat. Hist., XIII, fig. 5, (uncus and valvae), (1870).
Lintner, Ent. Cont. N. Y. State Cabinet Nat. Hist., plate 7, figs. 7 (male), 8 (female), figs. 11, 12 (male as *ausonius*), (1872).
Scudder, Butterflies, III, plate 9, fig. 12, plate 15, fig. 2 (as *ausonius*), plate 36, figs. 21, 22, 23 (genitalia) and fig. 33 (valve terminals of *ausonius*), (1889).
Holland, Butterfly Book, plate 48, fig. 4 (male), (1898).
Comstock, How to Know the Butterflies, plate 45, fig. 5, (male), (1904).
Skinner, Trans. Am. Ent. Soc., XL, p. 208 (valvae), (1914).
Lindsey, Univ. Iowa Stud., IX, plate 2, fig. 6 (valvae), (1921).

The male genitalia are well figured by Scudder. We agree with previous authors in placing *ausonius* Lintner as an aberrant *martialis*.

Additional Records: COLORADO, Coal Creek Canyon, July; Platte Canyon, May; Turkey Creek Canyon, July (all Oslar); VIRGINIA, Cold Knob, and Warm Springs, Bath County, July (Hebard); ALABAMA, Spring Hill, Mobile County, May (Dukes).

[14] Jour. N. Y. Ent. Soc., XIII, p. 121, (1905), under *brizo*.
[15] Dyar, Proc. U. S. Nat. Mus. XXVII, p. 788, (1904).

27. **Thanaos persius** Scudder

Scudder and Burgess, Proc. Boston Soc. Nat. Hist., XIII, fig. 1, (uncus and valvae) and fig. 2 (uncus and valvae as *lucilius*), (1870).
Lintner, Ent. Cont. N. Y. State Cabinet Nat. Hist., plate 7, figs. 1 (female), 2 (male) (as *lucilius*), (1872).
Scudder, Butterflies, III, plate 9, fig. 1, fig. 4 (as *lucilius*), plate 36, figs. 1, 2 and 3 (genitalia) and figs. 4, 5 and 6 (as *lucilius*), (1889).
Holland, Butterfly Book, plate 48, fig. 1 (male) and plate 48, fig. 10 (male) (as *lucilius*), (1898).
Comstock, How to Know the Butterflies, plate 45, fig. 3, (male), fig. 4, (male) (as *lucilius*).
Wright, Butterflies of West Coast, plate 32, fig. 461 (male), (1905).
Skinner, Trans. Am. Ent. Soc., XL, p. 204 (valvae), (1914).
Lindsey, Univ. of Iowa Stud., IX, plate 2, fig. 5, (valvae), (1921).

The male genitalia are well figured by Scudder. *Lucilius* Scudder was based on certain genitalic differences from *persius*, both types being from New England. In a long series of genitalic mounts we have made from *persius* from various localities, we find individual variation in these organs which include both forms figured by Scudder, and we cannot correlate the genitalic variation with any variation in maculation due to genesis, climate or geographical distribution of this species. We have the insect with genitalia corresponding to those of Scudder's *persius* from Eagle, Alaska, and from Cloudcroft, New Mexico, and the *lucilius* type from widely separated localities, and numerous intergrades. We have never been able to assign the name *lucilius* to any but smaller individuals with more contrasting coloration, out of a series with the same data and therefore believe that the name has no significance and should be dropped.

Additional Records: RHODE ISLAND, Elmwood, August; CONNECTICUT, Avon, July (Williams); NEW YORK, Centre, May (Hill); Mount Kisko (Hill); Catskill Mountains (Aaron); Bethlehem; NEW JERSEY, Elizabeth; Great Notch, Essex County, May; PENNSYLVANIA, Philadelphia; Delaware Water Gap, July; Reading, July; NORTH CAROLINA, Morgantown; Cranberry, August; TENNESSEE, Nashville, August (Thomas); FLORIDA, Osprey, March; Dunedin, April (Blatchley); ALABAMA, Mobile, April (Dukes); TEXAS, Corpus Christi (Aaron); NEBRASKA, Cedar Bluffs, May; Omaha, April, May, July, August; Sioux County, June; Dakota City, May (all Leussler); MICHIGAN, Oakland County, May (Newcomb); ALBERTA, Banff, July (Dod); BRITISH COLUMBIA, Windermere, July (Dod).

Thanaos persius race **afranius** Lintner

Holland, Butterfly Book, plate 45, fig. 5, (male), (1898).

Godman and Salvin, Biol. Cent.-Amer., Rhop., III, plate 91, figs. 24, 25 (male), 26 (genitalia), (1899).

The type of *afranius*, which was described from a single individual, should be in the New York State Museum at Albany, but Dr. E. P. Felt writes (1898) "of *afranius* I fail to find a single example, the type may be in the Edwards Collection." There is an insect marked "type" in the Museum of the Brooklyn Institute, which may be authentic. It differs from typical New England *persius* in that the superior wings have a decidedly grayish cast, in contrast to the brown color of the secondaries, and the fringes of the secondaries are gray. The size, however, is only a trifle smaller than average *persius*. Where we have series of this insect including two or more broods the early individuals seem to be smaller than the late broods.

Additional Records: COLORADO, Colorado Springs, May; Clear Creek, May; Chimney Gulch, May; Golden, May; Bear Creek, Morrison County, May; Durango, May, July; Platte Canyon, June; Salida, July (all Oslar); Jamestown, July (Dodge); Pike's Peak; NEW MEXICO, Jemez Mountains, April, May, June, July, August (Woodgate); Cloudcroft, May; Las Vegas, June, July (Snow); ARIZONA, Phoenix, August (Hill); CALIFORNIA, Nellie, July, August (Hewlett); Truckee, May; San Leandro, August; Fredalba, July; Pasadena, August; Los Angeles; UTAH, Park City, June, July; Ogden, July (Snyder); Salt Lake City; Sierra La Sal Mountains, July (Skinner); Provo, July; Payson Canyon, July; Stockton, July (all Spalding).

Thanaos persius race **pernigra** Grinnell

A very dark form, almost black, from Mount Tamalpais, Marin County, California, May. We have specimens from the type locality and from the Imperial Valley, September (Hebard). The male genitalia agrees with those of *persius*.

28. **Thanaos lilius** Dyar (Fig. 23.)

Grinnell, Ent. News, XV, p. 115, figs. 1, 2, 3 (one valve, uncus and aedoeagus, as *callidus*), (1904).

This insect was described[16] in June, 1904, from two specimens from Kaslo, British Columbia, altitude 1670 feet, May 31 and

[16] Dyar, Proc. U. S. Nat. Mus., XXVII, p. 788, (1904).

June 4. Dr. Dyar states "I have specimens from Easton, Washington and Yosemite Valley, California, June 16 and August 5."

Later Dyar states[17] "I imagine [*lilius*] will fall to *tibullus*—the genitalia are like *tibullus*—in the *lilius* examined the middle lobe of the left side piece is smooth without spines, otherwise—no difference."

We have specimens of *lilius* from Mr. Cockle from the type locality and presumably from the type catch. The male genitalia of these are quite different from those of *tibullus-propertius*, and we therefore concluded that the genitalic mounts made by Dyar were not from the type specimens. We have written Dr. Dyar on the subject and he has advised us that the mounts seem to be lost but "it is evident from the missing abdomens that two mounts were made from the two males from Easton, Washington and not from either of the Kaslo types. Your supposition in this respect was, therefore, perfectly correct."

As our Kaslo specimens answer the original description we feel sure that an examination of the male genitalia of the type will establish *lilius* as abundantly distinct from *propertius*. The insect seems to be well distributed through the Northwest. It is rather more variable than *persius*, from which we can hardly separate it, except by the male genitalic characters, which in turn are very close to those of *pacuvius*.

Additional Records: CALIFORNIA, Santa Cruz, May, June (Dodge); Donner Lake, July; Angeles Forest, May; Siskiyou County, June.

29. **Thanaos pacuvius** Lintner (Fig. 24.)

Holland, Butterfly Book, plate 48, fig. 9 (female), (1898).
Skinner, Trans. Am. Ent. Soc., XL, p. 215 (valvae), (1914).
Lindsey, Univ. of Iowa Stud., IX, plate 2, fig. 11 (valvae), (1921).

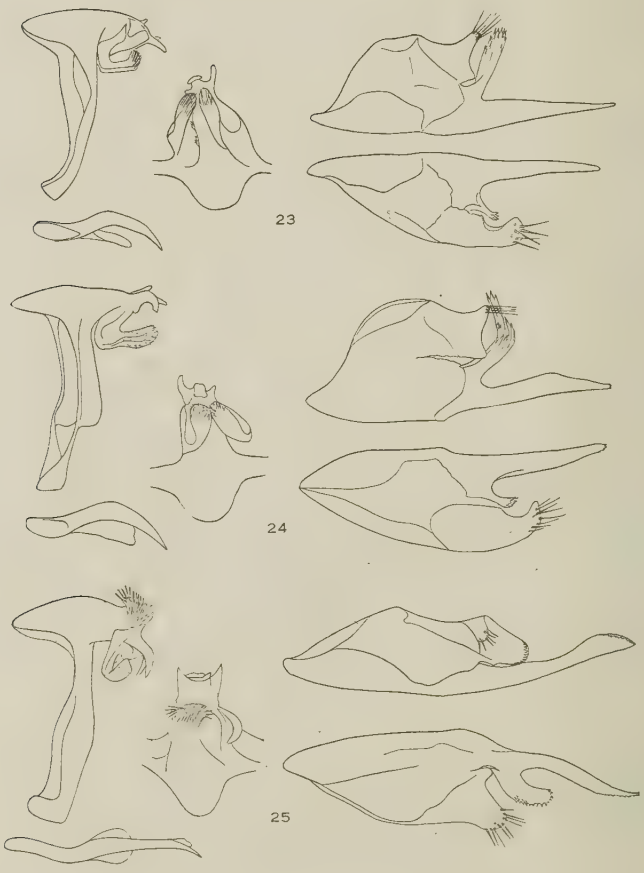
The male genitalia are practically the same as those of *lilius*.

Additional Records: COLORADO, Jamestown, July; Durango, May (Oslar), Coal Creek Canyon, July (Oslar).

30. **Thanaos scudderi** Skinner

Godman and Salvin, Biol. Cent.-Amer., Rhop., III, plate 91, figs. 16 (male), 17 (genitalia) as (*pacuvius*), (1899).
Skinner, Trans. Am. Ent. Soc., XL, p. 216 (valvae), (1914).
Lindsey, Univ. of Iowa Stud., IX, plate 2, fig. 12 (valvae), (1921).

[17] Journ. N. Y. Ent. Soc., XIII, p. 121, (1905).



23. *Thanaos lilius*, California. 24. *Thanaos pacuvius*, Mount Graham, Arizona. 25. *Thanaos propertius*, Victoria, British Columbia.

The male genitalia are quite different from those of any *Thanaos* we have seen. The valvae have been well figured and the uncus is well shown in the Godman-Salvin plate.

We have a number of specimens of this and *pacuvius* from southern Arizona (Morrison). We are only able to separate them by the male genitalia.

31. **Thanaos juvenalis** Fabricius

Smith and Abbot, Ins. Georgia, plate 21, (1797).
Boisduval and Leconte, Lep. Am. Sept., plate 65, (1833).
Doubleday and Hewitson, Gen. Diur. Lep., II, plate 79, fig. 3 (as *costalis*), (1852).
Scudder and Burgess, Proc. Boston Soc. Nat. Hist., XIII, fig. 10 (uncus and valvae), fig. 9 (uncus, valvae and details as *ennius*), fig. 16 (valve as *plautus*), (1870).
Scudder, Butterflies, III, plate 9, figs. 13, 14, plate 36, figs. 24, 25, 26, 27, 34, 35 (genitalia), (1889).
Holland, Butterfly Book, plate 48, fig. 11 (female), (1898).
Comstock, How to Know the Butterflies, plate 45, fig. 6 (male), (1904).
Skinner, Trans. Am. Ent. Soc., XL, p. 210 (valvae), (1914).
Lindsey, Univ. of Iowa Studies, IX, plate 2, fig. 7 (valvae), (1921).

The male genitalia are well figured by Scudder.

Dyar has suggested[18] that "*plautus* is not improbably *juvenalis* —the figure of the genitalia does not appear specifically different supposing the pieces to be in a different position—the right clasp may be broken." We believe this is the case, as *juvenalis* is now known to be a common insect in Florida, the type locality of *plautus*.

Additional Records: CONNECTICUT, Avon (Williams); RHODE ISLAND, Elmwood, May; NEW JERSEY, Woodbury, May; ILLINOIS, Quincy, April (Poling); MICHIGAN, Oakland County, May (Newcomb); NEW MEXICO, Jemez Mountains, May, June (Woodgate); Cloudcroft, May; Santa Fé Range; COLORADO, Durango (Oslar); TEXAS, Round Mountain, March; FLORIDA, Miami, January; Dunedin, March (Blatchley).

32. **Thanaos clitus** Edwards

Holland, Butterfly Book, plate 45, fig. 8 (male), (1898).
Godman and Salvin, Biol. Cent.-Amer., Rhop., III, plate 91, fig. 18 (genitalia) (as *maestus*), (1899).

[18] Journ. N. Y. Ent. Soc., XIII, p. 122, (1905).

Skinner, Trans. Am. Ent. Soc., XL, p. 217 (valvae), (1914).
Lindsey, Univ. of Iowa Stud., IX, plate 2, fig. 13 (valvae), (1921).

The male genitalia are well figured by Godman and Salvin. They are somewhat similar to those of *juvenalis*.

Additional Records: ARIZONA, Garcia, May (Biederman); COLORADO, Platte Canyon, July (Oslar).

33. **Thanaos tristis** Boisduval

Scudder and Burgess, Proc. Boston Soc. Nat. Hist., XIII, fig. 15 (uncus, valvae and details), (1870).
Godman and Salvin, Biol. Cent.-Amer., Rhop., III, plate 91, fig. 15 (genitalia), (1899).
Oberthür, Études. Lep. Comp., IX, plate 240, fig. 2081 (male, *type*), (1913).
Skinner, Trans. Am. Ent. Soc., XL, p. 219 (valvae), (1914).
Lindsey, Univ. Iowa Stud., IX, plate 2, fig. 14 (valvae), (1921).

The male genitalia are well figured by Godman and Salvin. They are quite different from those of *clitus*, from which, however, the insect can hardly be differentiated by other characters. Typical *tristis* has white fringes, while *tatius* has in addition white spots along the margin of the secondaries below. We have not seen any Californian individuals with this character, while most of the Arizonan material is so marked.

Thanaos tristis race **tatius** Edwards

The type is in the Museum of the Brooklyn Institute. The Arizona records given by Skinner refer to this form and not typical *tristis*. The male genitalia are the same in the two forms.

Additional Records: ARIZONA, Baboquivari Mountains, July (Poling); Mount Graham (type locality) (Morrison).

34. **Thanaos horatius** Scudder and Burgess

Scudder and Burgess, Proc. Boston Soc. Nat. Hist., XIII, fig. 13 (uncus, valvae and details), fig. 14 (uncus, valvae and details, as *virgilius*), (1870).
Scudder, Butterflies, III, plate 9, figs. 7, 10, plate 36, figs. 13, 14, 15, 16 (genitalia), (1889).
Holland, Butterfly Book, plate 48, fig. 15 (female not male), plate 48, fig. 7 (female not male, as *petronius*), (1898).
Skinner, Trans. Am. Ent. Soc., XL, p. 212 (valvae), (1914).
Lindsey, Univ. of Iowa Stud., IX, plate 2, fig. 9 (valvae), (1921).

The male genitalia are well figured by Scudder.

Additional Records: NEW JERSEY, Orange Mountains, August; Corson's Inlet, August (Williams); MARYLAND, Havre de Grace, June (Williams); SOUTH CAROLINA, Aiken; GEORGIA, State

College; ARKANSAS, Hope, August (Knobel); ALABAMA, Mobile, July; Daphne, August; Whistler, September (All Dukes); FLORIDA, Dunedin, March, April (Blatchley); TEXAS, San Antonio; NEW MEXICO, Jemez Mountains, July, August (Woodgate).

35. **Thanaos propertius** Scudder and Burgess (Fig. 25.)

Scudder and Burgess, Proc. Boston Soc. Nat. Hist., XIII, fig. 11 (uncus and valvae), fig. 12 (uncus, valvae and details as *tibullus*), (1870).
Wright, Butterflies of West Coast, plate 32, figs. 463 (male), 469 (male not female, as *tristis*), 462 (female as *juvenalis*), (1905).
Skinner, Trans. Am. Ent. Soc., XL, p. 211 (valvae), (1914).
Lindsey, Univ. of Iowa Stud., IX, plate 2, fig. 8 (valvae), (1921).

Additional Records: CALIFORNIA, Donner Lake, July; Angeles Forest, May (Duran); Greenhorn Mountains (Wright); Pasadena, March; Los Angeles; Sierra Madre Mountains, Los Angeles County, March; Yosemite, June; Palo Alto; Alma; Nellie, April, July (Hewlett); Santa Cruz, April (Dodge); Tahoe, July; Marin County, March (Fox); Duncan Hills, June (Fox); Fallen Leaf Lake, July; OREGON, Portland, April (Wright); COLORADO, Durango, May (Oslar); UTAH, Salt Lake City, May; City Creek Canyon, July; Wasatch Mountains, July (Skinner); NEW MEXICO, Alamogordo, April, May, (Viereck).

36. **Thanaos funeralis** Scudder and Burgess

Scudder and Burgess, Proc. Boston Soc. Nat. Hist., XIII, fig. 7 (uncus, valvae and details), (1870).
Holland, Butterfly Book, plate 48, fig. 12 (male), (1898).
Godman and Salvin, Biol. Cent.-Amer., Rhop., III, plate 91, figs. 10, 11 (male), 12 (genitalia), 13, 14 (female), (1899).
Wright, Butterflies of West Coast, plate 32, fig. 468 (female), plate 32, fig. 446 (female as *clitus*), (1905).
Skinner, Trans. Am. Ent. Soc., XL, p. 220 (valvae), (1914).
Lindsey, Univ. of Iowa Stud., IX, plate 2, fig. 15 (valvae), (1921).

The male genitalia are well figured by Godman and Salvin.

Additional Records: CALIFORNIA, Pasadena, July; Tehachapi; Nellie, July (Hewlett); Los Angeles, June, July; La Canyada, Los Angeles County, May (Coolidge); Aguanga, Riverside County, June, July; ARIZONA, Chiricahua Mountains, June (Stone); Ajo, Pima County, September (Hebard); Hot Springs, July, September, October; Garcia, August; Paradise, July (Duffner); Baboquivari Mountains, April, July, September

(Poling); Prescott, July; New Mexico, Jemez Mountains, July, August, September, (Woodgate); Texas, Cypress Mill, April; Tiger Mill, April, (Schaupp); Corpus Christi (Aaron).

37. **Thanaos zarucco** Lucas

Scudder and Burgess, Proc. Boston Soc. Nat. Hist., xiii, fig. 6 (uncus and valvae, as *terentius*), fig. 8 (uncus as *ovidius*), (1870).
Scudder, Butterflies, iii, plate 9, fig. 15, plate 36, figs. 17, 18, 19, 20, 28, 29 (genitalia) (as *terentius*), (1889).
Holland, Butterfly Book, plate 48, fig. 3 (male not female, as *terentius*), (1898).
Skinner, Trans. Am. Ent. Soc., xl, p. 213 (valvae, as *terentius*), (1914).
Lindsey, Univ. of Iowa Stud., ix, plate 2, fig. 10 (valvae, as *terentius*), (1921).

This insect from Cuba and the insect from Florida known as *terentius* are practically the same. A comparison of the male genitalia confirms our conclusion that the name *terentius* must fall to the older one.

The male genitalia, well figured by Scudder, are very close to those of *funeralis*, and the two species have much the same appearance except for the white fringes of the latter.

Additional Records: Florida, Gulfport (Reynolds); Tampa, January (Williams); St. Petersburg, September; Dunedin, March (Blatchley); Georgia, Thomasville, March (Hebard); State College; North Carolina, Raleigh, May, July (Brimley); Tennessee, Nashville, August; Pennsylvania, Philadelphia, July (Aaron); New Jersey, Elizabeth, July.[19]

38. **Megathymus neumoegeni** Edwards

Druce, Biol. Cent.-Amer., Rhop., ii, plate 69, fig. 4 (male), (1896).
Barnes and McDunnough, Cont. Lep., i, plate 1, figs. 4 (female), 5, 6, 7 (males), figs. 1, 2 (males as *aryxna*), 3 (female), plate 5, figs. 5, 6 (valvae), plate 4, figs. 13 (uncus), (1912).

Barnes and McDunnough[20] published a valuable and interesting paper on the genus *Megathymus* and we wish to make some remarks on several species in the genus. Mr. W. H. Edwards described *neumoegeni* from one male and two females and mentions another female. We have seen the types in the Brooklyn Museum and agree with Barnes and McDunnough that the type material therein agrees with their figure, plate 1, figure 4, ♀.

[19] *Thanaos gesta* Herrich-Schaeffer has been treated in a previous paper and the male genitalia figured. Trans. Am. Ent. Soc., xlviii, pp. 304, 305, (1923).
[20] Cont. Lep., i, no. 3, (1912).

We are of the opinion that the Edwards description of a male was made from a female. Barnes and McDunnough suggest this, or that the labels were shifted. Mistakes in regard to the sexes of species of this genus have been made previous to the study of the genitalia, and we think Mr. Edwards described his male and female from two females. Barnes and McDunnough state that there is a male in the Strecker Collection and a male in the Barnes Collection. There is also a male in the collection of the Academy of Natural Sciences of Philadelphia. These three males were evidently from the original catch, the last having been received in exchange. In our opinion the type should be a female in the collection of the Brooklyn Institute. We have female specimens agreeing with the type, which were determined years ago. This all leads up to another question. Barnes and McDunnough say "Dr. Dyar, misled by the type labels on the Neumoegen specimens, described the ♂ of *neumoegeni* under the name *aryxna*." This was undoubtedly the case. This is proven by the original description of *aryxna*, which is as follows:—"This is the form figured in the Biologia Cent.-Am. Lep. Het. III, pl. 69, figs. 3 and 4. It differs from *neumoegeni* in having the fulvous markings considerably reduced, the outer band being broken into spots. I have ten specimens from Arizona from Dr. Barnes and Mr. Poling."

Figure 3 mentioned above is not *neumoegeni*. Dr. Skinner[21] has suggested the name *drucei* for this figure. Fig. 4 is an accurate figure of *neumoegeni* and we select this figure as the type of *aryxna* Dyar. Dr. Dyar in his table[22] separates *aryxna* from *neumoegeni* by the difference in the submarginal fulvous band, and these differences are sexual, male and female. A description can be made from a specimen or a figure and there can be no question about what Dr. Dyar meant by *aryxna;* it it was the male of *neumoegeni*. Barnes and McDunnough endeavor to divide *aryxna* into two species, but *aryxna* is a synonym of *neumoegeni*, as indicated, and moreover with our best efforts in the study of the differences as given by Barnes and McDunnough, we are unable to find two species. We have large series and have carefully studied the maculation and a

[21] Trans. Am. Ent. Soc., XXVIII, p. 207, (1911).
[22] Journ. New York Ent. Soc., XIII, p. 141, (1905).

series of genitalic mounts. The shifting of the concept by Dyar at the suggestion of Barnes and McDunnough is not valid.

Records: ARIZONA, Paradise, September (Duffner); Reef, September, November, (Biederman); Baboquivari Mountains, September (Poling).

39. **Megathymus polingi** Skinner

Barnes and McDunnough, Cont. Lep., I, plate 2, figs. 5, 7 (male), 6, 8 (female), plate 4, fig. 12 (uncus), plate 5, fig. 7 (valve), (1912).

The male genitalia are the same as those of *neumoegeni*.

Records: ARIZONA, Cochise County (Poling); Redington.

40. **Megathymus mariae** Barnes and Benjamin

Cont. Lep., V, p. 100, (1924).

The male genitalia of *mariae* are identical with those of *neumoegeni* and *polingi*. We see no way to adequately separate the males of *polingi* and *mariae* by maculation. With a limited amount of material before us of *mariae* (one male, one female, El Paso, Texas, October), we are unable to express an opinion as to its exact status, but think it to be a topomorph and not a distinct species.

41. **Megathymus stephensi** Skinner[23]

Wright, Butterflies of West Coast, plate 32, fig. 483 (male, not female, as *neumoegeni*), (1905).

The male genitalia of this species are almost the same as those of *neumoegeni*.

The type is from La Puerta, San Diego County, California, November 11.

42. **Megathymus yuccae** Boisduval and Leconte

Boisduval and Leconte, Lep. Am. Sept., plate 70, (1833).
Barnes and McDunnough, Cont. Lep., I, plate 5, fig. 2 (valve), (1912).

Records: FLORIDA, Enterprise (Castle); Georgiana, March (Carter); Venice (Bonniwell) (emerged Philadelphia in April); SOUTH CAROLINA, Bluffton (Mellichamp).

Megathymus yuccae race **coloradensis** Riley

Barnes and McDunnough, Cont. Lep., I, plate 1, figs. 8, 9 (males), plate 4, fig. 11 (uncus), plate 5, fig. 3 (valve), (1912).

[23] Ent. News, XXIII, p. 126, (1912).

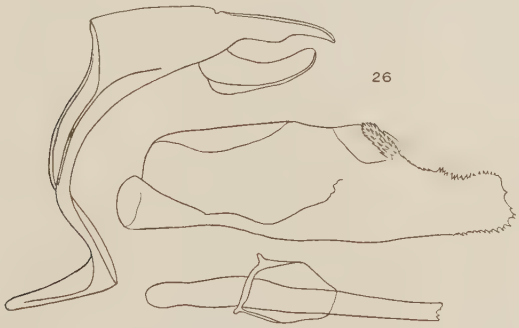
This is the Colorado form, small and chestnut brown. The male genitalia are the same as those of typical *yuccae* except for size.

Megathymus yuccae race **navajo** Skinner

Skinner, Trans. Am. Ent. Soc., xxxvii, plate 10, (male), (1911).

This is the New Mexico form, small and black. The male genitalia are the same as those of typical *yuccae*.

Records: New Mexico, Fort Wingate, May (*type*); Jemez Mountains, April (Woodgate).



26. *Megathymus cofaqui*, Venice, Florida.

43. **Megathymus cofaqui** Strecker (Fig. 26.)

Strecker, Lep. Rhop. Het., plate 15, fig. 2 (female), (1878).

Barnes and McDunnough, Cont. Lep., i, page 34, and plate (female type), (1912).

Records: Florida, Tampa, March (Bell); Georgiana, August (Carter); Venice (Bonniwell) (emerged Philadelphia, April); Georgia, Tifton (Pilate).

44. **Megathymus streckeri** Skinner

Strecker, Bull. Brooklyn Inst., iii, p. 66 (figure as *cofaqui* male), (1880).

Skinner, Ent. News, xi, p. 414, plate 2, fig. 27 (male), (1900).

Barnes and McDunnough, Cont. Lep., i, plate 2, figs. 1, 3 (male), 2, 4 (female), plate 4, fig. 14 (uncus), plate 5, fig. 4 (valve), (1912).

Records: Arizona (Morrison, *type*); New Mexico, Highrolls, June (Viereck); Colorado, Durango, May, June (Oslar); Nebraska, Sand Hills, Dewey Lake, Cherry County, June (Leussler).

Megathymus streckeri race **texana** Barnes and McDunnough

Barnes and McDunnough, Cont. Lep., I, plate 2, fig. 9 (female), (1912).

45. **Megathymus ursus** Poling

Poling, Ent. News, XIII, plate 4 (female), (1902).

Described from a unique female and resembling a giant *streckeri*.

46. **Megathymus smithi** Druce

Druce, Biol. Cent.-Am., Het., II, plate 69, fig. 5, (1896).

Barnes and McDunnough, Cont. Lep., I, plate 4, fig. 15 (uncus), plate 5, fig. 8 (valve), (1912).

Dr. William Barnes has recorded it from Corpus Christi, Texas.

47. **Megathymus drucei** Skinner [24]

Druce, Biol. Cent.-Amer., Het., II, plate 69, fig. 3, (as *neumoegeni*), (1896).

Druce in the Biologia records this from Northern Sonora (Morrison). Swartz[25] says that when Morrison's material was sent abroad it was labeled "Sonora," and when sent to American workers labeled "Arizona," and was probably all caught in the Graham Mountains near Fort Grant, Arizona, so on this basis we add it to our faunal list.

[24] Trans. Amer. Ent. Soc., XXXVII, p. 207, (1911).

[25] Proc. Ent. Soc. Washington, IV, p. 209, (1897).

STUDIES IN JAPANESE ACRIDIDAE (ORTHOPTERA)

BY MORGAN HEBARD

The following paper is based on material which has long been in the possession of the Academy of Natural Sciences of Philadelphia and that of the author. Though a large proportion of the Japanese species are represented by large series, a number of the scarcer forms, many of which are probably peculiar to Japan, are not included. This is particularly unfortunate as it prevents the definite generic assignment of the following species, which have, almost certainly, been incorrectly placed generically at the time they were described by Shiraki: *Paratettix hachijoensis, Oedipoda akitana, Oxya yezoensis, Podisma kodamae* and *Podisma kawakamii.*

We have, however, been able to indicate a number of synonymic names, as large collections from southeastern China, the Philippines and Malaysia are now available for comparison.

Shiraki listed sixty-two species and one race of Japanese Acrididae, of which twenty-two are Formosan. As that island has a very distinct fauna from Japan proper, it should never have been treated as representing a portion of the latter's fauna. Its biological correlation is properly with that of the much nearer coast of southeastern China. This would leave forty Japanese forms, which probably include two synonyms and a color phase, while in the present paper three species are added, leaving a total for the Japanese fauna of forty species. Of these, four do not occur north of the Loo Choo Islands, so that thirty-six species are recognized as actually known from Japan proper.

A total of eleven hundred and sixty-six specimens are here recorded, representing twenty-seven species, of which three are, in Japan, referable to geographic races, and two phases of the remarkable *Locusta migratoria* are there found.

The material is the property of the Academy of Natural Sciences of Philadelphia, except a large portion of that from Kyoto and the Loo Choo Islands, which belongs to the author.

It is evident that the bulk of Japanese genera are Palaearctic or even Holarctic, and that only a few of the more widely distributed Oriental forms reach so far northward.

We wish to appeal to all who may be interested in the Dermaptera and Orthoptera of Japan, to strive to clear up the numerous uncertainties which still exist. Japanese students and collectors interested in the fauna of their country have always shown keen enthusiasm and much has already been accomplished by Drs. Matsumura and Shiraki. The assembling of large collections in these orders has, however, apparently been checked in Japan by lack of sufficiently complete libraries to pursue such studies in a satisfactory manner. Opportunity to make comparisons with allied exotic forms has also been most difficult.

We gladly volunteer any aid which we may be able to give, and feel that, with the very complete library at the Academy of Natural Sciences of Philadelphia and now extremely large collections from southeastern China, the Philippines and many other Asiatic regions, very satisfactory progress can be made. One of the most interesting problems to clear up is the queried generic assignment of certain species described by Shiraki, with special attention to all forms of the genus *Podisma*.

Acrididae

acrydiinae

Group *Scelimenae*

Acanthalobus bispinosus japonicus (Haan)

1839. *A[crydium] (Tetrix) bispinosum* var. *japonicum* Haan, Verh. Natuur. Geschied. Nederl. Overzee. Bezitt., Zool., Ins., p. 169. [♂, ♀; (Japan, by inference).]

Nishigo, Uzen, 9 ♂, 12 ♀. Loo Choo Islands, 6 ♂, 9 ♀.

The Loo Choo series averages distinctly smaller than that from Uzen.

Group *Acrydi*

Euparatettix histricus (Stål)

1860. *Tetrix histrica* Stål, Kongl. Svenska Freg. Eugenie's Resa, Zool., I, p. 347. [♂, Java.]

Loo Choo Islands, 3 ♂, 4 ♀.

These specimens agree closely with a Javanese series in the author's collection. The validity of *Euparatettix* is not certain; recent authors having referred this species to *Paratettix*, though some of Hancock's last determinations show that he considered *histricus* a member of the former genus.

Acrydium japonicum (Bolivar)

1887. *T[ettix] japonicus* Bolivar, Ann. Soc. Ent. Belgique, XXXI, p. 263. [♀, Japan.]

Kyoto, Yamashiro, 11 ♂, 9 ♀, 5 juv. Kobe, Settsu, 4 ♂, 2 ♀. Nishigo, Uzen, 2 ♂, 10 ♀, 8 juv.

ACRIDINAE

Group *Acridae*

Acrida turrita Linnaeus

1758. *G[ryllus] A[crida] turritus* Linnaeus, Syst. Nat., Ed. X, p. 427. [Africa.]

Nishigo, Uzen, 9 ♂, 8 ♀. Kanagawa, Musashi, (S. Flight), 2 ♀. Yokohama, Musashi, (H. Loomis), 5 ♀. Kyoto, Yamashiro, 48 ♂, 57 ♀. Loo Choo Islands, 10 ♂, 15 ♀.

This is the species recorded from Japan by Rehn and by Shiraki as *A. nasuta* Linnaeus. That name applies instead to an African insect having red wings, as has been recognized by Kirby and since noted by Rehn.

Group *Gelastorhini*

Gonista bicolor (Haan)

1842. *A[cridium] (Opsomala) bicolor* Haan, Verh. Natuur. Geschied. Nederl. Overzee. Bezitt., Zool., Ins., p. 148. [♂, ♀: Java; Japan.]

1898. *Gonista antennata* Bolivar, Ann. Mus. Genova, XXXIX, p. 93. [♀; Siboga, Sumatra.]

1899. *Gelastorrhinus gracilis* Fritze, Rev. Suisse de Zool., VII, p. 338, pl. 16, figs. 1, 1a, 1b. 1c. [♂; Deli, Sumatra.]

1902. *Gelastorrhinus esox* Burr, Trans. Ent. Soc. London, 1902, p. 183. [♂, ♀; Japan.]

Yokohama, Musashi, (H. Loomis), 1 ♂.

In 1898, Bolivar apparently did not consider Haan's description of *bicolor*, as his generic and specific description agrees fully with the insect which we are convinced represents that species, and of which we have an additional male from Java and a series from southeastern China.

Fritze's description and figures leave much to be desired, but are apparently based on a poorly preserved male of the same insect. The tegminal margin, as figured, alone is different, and we are strongly of the opinion that distortion of the costal margin is the cause of this.

The difference in tegminal venation noted by Burr for his *esox* is of no value and both his species, *esox* and *lucius*, represent the present insect. The latter name has already been referred to synonymy under *bicolor* by Kirby.

The genus *Gonista* Bolivar is apparently nearest *Carcharacris* Bolivar, described from Assam in 1914. A portion of the above confusion has been caused by the fact that the Group Gelastorhini, to which *Gonista*, *Carcharacris* and *Gelastorhinus* belong,[1] is strikingly Acridine, except that a prosternal production is developed, which has led to assignment of species, at numerous times, to the Cyrtacanthacrinae. Thus Bolivar originally referred *Gonista* to the Cyrtacanthacrinae and did not consider that genus in his Truxaline (Acridine) studies of 1914, though at that time he included, we believe correctly, the Gelastorhini in the Acridinae, as Burr already had done in 1902.

In this and the related genera the prosternum is protuberant cephalad, its cephalic face flattened, its apex with a small tubercle and a still smaller tubercle on each side.[2] Though the prosternum is, as a rule, flat and unspecialized in the Acridinae, the affinities of the present genera are so evidently with other genera of that subfamily, that it would violate common sense to refer them to the Cyrtacanthacrinae.

Group *Mecostethi*

This name must be used in place of Parapleuri, while the group which has been known as the Mecostethi must now be recognized as the Stethophymata.

Due to Kirby's unfortunate dislike for tautonymy, that author in 1910 selected *Gryllus parapleurus* (= *alliaceus*) as type of *Mecostethus* and *Gryllus grossus* as type of *Stethophyma*. In the absence of previous genotypic designation these assignments hold, *Mecostethus* having originally included *parapleurus*

[1] But not *Euthynous*, as supposed by Bolivar.

[2] These tubercles are very blunt and feebly indicated in *G. edax* (Saussure), from Madagascar.

(= *alliaceus*) and *grossus*,[3] and *Stethophyma* having originally included *grossus* and *variegatus* (= *Arcyptera fusca*).[4] It is most unfortunate that this action has placed in synonymy the long recognized generic name *Parapleurus* and has assigned to that unit the name *Mecostethus*, which similarly had long been assigned to another unit now, of necessity, bearing the name *Stethophyma*.

Mecostethus alliaceus (Germar)

1817. *Gryllus alliaceus* Germar, Fauna Ins. Eur., XI, pl. 19. [Illyria.]
1902. *Parapleurus fastigiatus* Rehn, Proc. Acad. Nat. Sci. Phila., 1902, p. 629. [♂, ♀; Japan.]

Comparison of European material with the originally described series of *fastigiatus*, in the Academy collection, shows that no feature exists upon which specific separation may be maintained. Rehn was evidently misled by the form of his dried alcoholic material, lack of other material for comparison and the wide separation of the Japanese series from the regions from which *alliaceus* had been previously recorded.

Nishigo, Uzen, 30 ♂, 28 ♀. Region between Nikko and Kyoto, (H. C. Wood), 2 ♂, 2 ♀, *type*, *allotype* and *paratypes* of *Parapleurus fastigiatus* Rehn. Kyoto, Yamashiro, 4 ♂, 2 ♀. Yokohama, Musashi, (H. Loomis), 1 ♀.

Group *Gomphoceri*

Stauroderus bicolor (Charpentier)

1825. *Gryllus bicolor* Charpentier, Horae Ent., p. 161. [♂, ♀; Silesia and Switzerland.]

Nishigo, Uzen, 29 ♂, 30 ♀. Kyoto, Yamashiro, 3 ♂, 11 ♀.[5]

This material agrees in every way with European specimens of the species in the Philadelphia collections.

Stauroderus latipennis (Bolivar)

1898. *Stenobothrus latipennis* Bolivar, Ann. Mus. Civ. Stor. Nat. Genova, XXXIX, p. 83. [♂: Corea; Yamada, eastern Japan.]
1910. *Stenobothrus fumatus* Shiraki, Acrididen Japans, p. 25, pl., figs. 6a to c. [♂, ♀; Aomori, Japan.]

[3] Fieber in Kelch, Orth. Oberschles., p. 1, (1852).
[4] Fischer, Orth. Europ., p. 357, (1853).
[5] Part of this series was erroneously referred to *S. latipennis* (Bolivar) by Rehn, Proc. Acad. Nat. Sci. Phila., 1902, p. 631.

Region between Nikko and Kyoto, (H. C. Wood), 2 ♂, 2 ♀. Nagasaki, Hizen, (from Fruhstorfer), 1 ♂.

Shiraki's description agrees so closely with Bolivar's that we feel little hesitation in indicating the above synonymy.

Group *Stethophymata*

Stethophyma magister (Rehn)

1902. *Mecostethus magister* Rehn, Proc. Acad. Nat. Sci. Phila., 1902, p. 631. [♂; region between Nikko and Kyoto, Japan.]

The unfortunate selection of genotypes by Kirby, noted on pages 212–213, obliges the above generic change. Examination of the type, in the Academy Collection, shows that the species is, as stated by Rehn, apparently nearest the North American *S. lineatum* (Scudder).

Group *Aiolopi*

Aiolopus tamulus (Fabricius)

1798. *G[ryllus] tamulus* Fabricius, Ent. Syst., Suppl., p. 195. [East Indies.]

Kyoto, Yamashiro, 6 ♂, 5 ♀. Loo Choo Islands, 10 ♂, 13 ♀.

OEDIPODINAE

Oedaleus infernalis Saussure

1884. *O[edaleus] infernalis* Saussure, Prodr. Oedipod., p. 116. [♂, ♀; Japan.]

Nishigo, Uzen, 40 ♂, 32 ♀. Yokohama, Musashi, 2 ♀. Kyoto, Yamashiro, 1 ♂, 9 ♀.

A small portion of the present series was determined by Rehn, in 1902, as *O. nigrofasciatus* (DeGeer), a species which does not occur in Japan.

Oedaleus marmoratus (Thunberg)

1815. *G[ryllus] marmoratus* Thunberg, Mém. Acad. Imp. Sci. St. Pétersbourg, v, p. 232. [Cape of Good Hope.]

Stål's description of the type, and statement that the locality originally given was probably in error, leads to the present association.[6]

Yokohama, Musashi, (H. Loomis), 2 ♂, 6 ♀. Kyoto, Yamashiro, 12 ♂, 7 ♀. Loo Choo Islands, 7 ♂, 21 ♀.

Part of the present series was determined in 1902, by Rehn, as *O. nigrofasciatus* (DeGeer), a species not occurring in Japan.

[6] See Recensio Orth., I, p. 123, (1873).

Locusta migratoria phase **danica** Linnaeus

1767. *G[ryllus] L[ocusta] danicus* Linnaeus, Syst. Nat., Ed. XII, p. 702. [Denmark.]

Kanagawa, Musashi, (S. F. Light), 1 ♀. Yokohama, Musashi, (H. Loomis), 2 ♂. Kyoto, Yamashiro, 31 ♂, 58 ♀. Sapporo, Ishipari, December, 1896, (M. Matsumura), 1 ♂. Ogasawara (= Bonin) Islands, 16 ♂, 30 ♀. Loo Choo Islands, 2 ♀.

The development of the phases of this migratory and highly injurious species has, we believe, been masterfully solved by Uvarov.[7] Extremely large series before us from Europe, Africa and Asia, fully bear out his conclusions.

The Ogasawara individuals are of particular interest in showing a strong tendency toward the condition found in the Fiji Islands. They are more buffy brown in general coloration, a green phase is very rarely encountered (and then very weakly manifested) and the size averages considerably smaller than in typical *danica*. We believe that the Fijian insect should be recognized as a Polynesian race, for which the name *Locusta migratoria australis* (Saussure) is available.

Measurements (in millimeters) of extremes

	Length of tegmen		Length of caudal femur	
migratoria phase *danica*	♂	♀	♂	♀
Kyoto, Japan, 31 ♂, 58 ♀	40.3 to 44.2	49.3 to 60.3	22.8 to 24.8	25.8 to 31.7
Loo Choo Islands, 2 ♀	.....	49 and 52.2	.....	26 and 27.7
atypical *danica*				
Ogasawara Islands, 16 ♂, 30 ♀	33.2 to 38.3	42.8 to 49.2	19.5 to 20.8	24.8 to 26
migratoria australis				
Fiji Islands, 3 ♂	28.3 to 29.8	.....	17.7 to 18.8	.....

Sphingonotus japonicus Saussure

1888. *Sph[ingonotus] japonicus* Saussure, Addit. Prodr. Oedipod., p. 84. [♂, ♀; Japan.]

Kyoto, Yamashiro, 21 ♂, 35 ♀.

This is one of the handsomest species of the genus, which includes many of the most distinctive species of the Oedipodinae.

[7] Bull. Ent. Research, XII, pp. 135 to 163, (1921).

Heteropternis varia (Walker)

1870. *Epacromia varia* Walker, Cat. Dermapt. Saltat. British Mus., iv, p. 774. [♂, ♀; Hong Kong and Amoy, China.]

1888. *H[eteropternis] pyrrhoscelis* var. ? *sinensis* Saussure, Addit. Prodr. Oedipod., p. 46. [♂, ♀; Kiang-Si, China.]

1910. *Oedipoda rufipes* Shiraki, Acrididen Japans, p. 37. [♂, ♀: Okinawa, [Loo Choo Islands], and Formosa.]

This insect is apparently distinct from Javanese and southern Indian material before us. We feel that very careful revision will be necessary before anyone can be justified in placing *varia* and *pyrrhoscelis* in synonymy under *respondens*. The series at present available is not sufficient to prove more than that several phyla apparently exist. The material before us from Kiang-Su, China, the Loo Choo Islands and Japan, including twenty-one specimens, all represents *varia*, a compact and robust stock having the wings faintly tinged proximad with yellow or dull orange.

The descriptions leave no doubt that Saussure's *sinensis* is the same as Walker's *varia*.

From the literature and our series it is evident that Shiraki's synonym *rufipes* was due to his having overlooked the important generic characters which separate *Heteropternis* and *Oedipoda*. The former is readily recognized by the caudal femora not narrowing suddenly meso-dorsad, and by the very unequal inner spurs of the caudal tibiae.

Kyoto, Yamashiro, 4 ♂, 3 ♀. Loo Choo Islands, 4 ♂, 7 ♀.

Trilophidia annulata japonica Saussure

1888. *Tr[ilophidia] annulata* var. *japonica* Saussure, Addit. Prodr. Oedipod., p. 54. [♂, ♀; Japan.]

Kyoto, Yamashiro, 2 ♂, 3 ♀.

Comparison with material of *annulata* from southeastern China shows that *japonica* is almost certainly a distinct geographic race and not a mere variety. Such was first indicated by Rehn in 1902.

The species apparently develops very decided geographic diversity, material from the Philippine Islands demonstrating that *cristella* (Stål) represents another geographic race.

The very large size and proportionately more elongate caudal femora, of the insect as found in Japan, may eventually necessitate specific separation.

PYRGOMORPHINAE

Atractomorpha bedeli Bolivar

1884. *Atractomorpha bedeli* Bolivar, Anal. Soc. Española Hist. Nat., XIII, p. 69. [♀; Yokohama, Japan.]

Nishigo, Uzen, 14 ♂, 10 ♀. Yokohama, Musashi, 1 ♀. Kyoto, Yamashiro, 15 ♂, 24 ♀. Sapporo, Ishikari, December, 1896, (M. Matsumura), 1 ♂. Loo Choo Islands, 1 ♂, 1 ♀.

CYRTACANTHACRINAE

Oxya intricata Stål

1860. *Acridium* (*Oxya*) *intricatum* Stål, Kongl. Svenska Freg. Eugenie's Resa, I, Ins., p. 335. [♂: Java; Singapore, Malacca (= British Straits Settlements); Hong-Kong, [China].]

Loo Choo Islands, 1 ♂.

Selecting Singapore as the type locality, we find that the present specimen agrees closely with two topotypic males in the author's collection.

Other material from southeastern China, Siam, the Philippine Islands, Borneo and the Moluccas before us, shows that the insect is decidedly variable, developing striking color phases which appear to have some geographic significance.

This insect is not known from the islands of Japan proper.

Oxya vicina Brunner

1893. *O*[*xya*] *vicina* Brunner, Ann. Mus. Civ. Stor. Nat. Genova, XXXIII, p. 152. [♂, ♀: Amoy, Shanghai and Island of Hainan, China; Japan; Himalaya Mountains.]

Yokohama, Musashi, 1 ♀. Kyoto, Yamashiro, 13 ♂, 17 ♀. Loo Choo Islands, 25 ♂, 29 ♀.

Though a few of the Kyoto specimens represent the same condition found in the Loo Choo Islands, here described under *O. velox* (Fabricius), the majority of that series represent a large and decidedly heavier condition, with organs of flight showing slight to very decided reduction.[8] This heavy condition would appear to deserve nominal recognition as a phase or race of *vicina*, but when the decided plasticity of the species is considered we believe that such a course would certainly be unjustified at the present time.

[8] Failing to reach the apices of the caudal femora to (rarely) distinctly less than the caudal femoral length and dorsum usually not suffused (though weakly to strongly suffused in a few individuals).

Oxya velox (Fabricius)

1787. *G[ryllus] velox* Fabricius, Mantissa Ins., I, p. 239. [China.]

Kyoto, Yamashiro, 20 ♂, 22 ♀.

These specimens, we believe, represent the typical condition of this very plastic species. They are large, with tegmina and wings extending well beyond the apices of the caudal femora and all but a very few have the occiput, dorsum of the pronotum and dorsal fields of the tegmina strongly suffused with cinnamon brown. These features are not, however, of any specific diagnostic value. Other material of the species before us from Hawaii (where it has apparently been introduced), the Solomon Islands, the Philippines, Borneo and southeastern China shows decided differences in size and development of the organs of flight, though the dorsal suffusion is rarely reduced or absent. On the other hand the Loo Choo Islands series of *O. vicina* (Brunner) agrees fully in these features, though most material of that insect before us lacks dorsal suffusion.

Patanga japonica (Bolivar)

1898. *Acridium japonicum* Bolivar, Ann. Mus. Civ. Stor. Nat. Genova, XXXIX, p. 98. [♂, ♀; Yokohama, Japan.]

Yokohama, Musashi, (H. Loomis), 5 ♂, 4 ♀, 1 juv. Japan, (exchange with British Museum, through Uvarov), 1 ♂, 1 ♀.

In addition to the characters given by Uvarov[9] to separate this insect from the closely related *P. succincta* (Linnaeus), we note that the dorsal portion of the frontal costa is crowded with coarse impressed punctae in *japonica*, scatteringly supplied with very fine impressed punctulae in *succincta*.

The extremes in the present series are: length of body, ♂, 33 to 37; ♀, 43.5 to 46: length of tegmen, ♂, 30.2 to 33.4; ♀, 40.8 to 45.1 mm.

All that are properly preserved have the wings, toward their bases, very delicately tinged with jasper pink.[10] This proximal tinting of the wings is never as clear as in *succincta* and is of a less purplish shade.

[9] Ann. Mag. Nat. Hist., (9), XII, p. 364, (1923).

[10] We believe that Shiraki has recorded material of this species correctly, but that he examined discolored material in which the pink of the wings was subobsolete or lost, as he stated that the wings were hyaline. Discolored material is before us in which such is the case. See Acrididen Japans, p. 67, (1910).

An unreported series of *japonica* from the Indian Himalayas is before us which agrees very closely except in being very slightly less robust, with organs of flight slightly more elongate.

Patanga succincta (Johannson)

1763. *Gryllus succinctus* Johannson, Amoenit. Acad., VI, p. 398. [Java.]

Kyoto, Yamashiro, 7 ♂, 7 ♀. Loo Choo Islands, 23 ♂, 23 ♀.

Some of the more brilliantly colored individuals have the pale markings of pronotum and tegmina lemon yellow.

PODISMA Latreille

Considerable confusion is found in the status of the Japanese species of this genus. Scudder in 1897[11] described a *Podisma dairisama*, at that time stating that the two species described and referred to *Pezotettix* by Bolivar were apparently members of the genus *Podisma*, but could not be definitely assigned. It appears very probable that *dairisama* is a synonym of one of the latter, *fauriei*, described in 1890[12] and apparently based on discolored material. Unfortunately no material is at hand at the present time to determine this.

In Shiraki's treatment of the genus in 1910,[13] two new species are described which very possibly should not be referred to *Podisma*, these are *kodamae* and *kawakamii*. Again lack of material prevents a definite decision.

Podisma mikado (Bolivar)

1890. *Pezotettix mikado* Bolivar, Anal. Soc. Española Hist. Nat., XIX, p. 323. [♀; Yezo, Japan.]

Nishigo, Uzen, 21 ♀. Between Tokyo, Nikko and Kyoto, (Dr. H. C. Wood), 1 ♂, 4 ♀, 3 juv. Sapporo, Ishikari, December, 1896, (M. Matsumura), 1 ♀. Tsushima (= Tsu Islands), September and October, (from Fruhstorfer), 1 ♀.

The tegmina of the female from the Tsu Islands show appreciable flattening of the margins distad to a rounded apex, these organs being very evenly and broadly convex in the normal con-

[11] Proc. U. S. Nat. Mus., XX, p. 114.
[12] Anal. Soc. Española Hist. Nat., XIX, p. 322.
[13] Acrididen Japans, pp. 69 to 78.

dition. This difference may indicate racial or higher significance, but, without males from that region, it is best considered a matter of individual variation.

Kirby has assigned *mikado* both to *Prumna* and *Podisma* in his Catalogue. Though the species is unusual among the forms of *Podisma* in its large size and broadly convex caudal margin of the pronotum, the male genitalia are in no way signally different from the types developed in *Podisma*, as are those of *Prumna*.

This is a very handsome species, being jade green in general coloration, with ventral surface of caudal femora to near distal portion jasper red, the cephalic and median limbs and ventral surface greenish yellow. In some specimens the general coloration is darker, with a post-ocular bar, moderately indicated to the principal pronotal sulcus, and tegmina mars brown.

Podisma longipennis Shiraki

1902. *Coptacra foedata* ? Rehn, Proc. Acad. Nat. Sci. Phila., 1902, p. 636. [♂, ♀; Japan.][14]

1910. [*Podisma sapporense*] variety *longipenne* Shiraki, Acrididen Japans, p. 77. [Hogi and Sapporo, Japan.]

Nishigo, Uzen, 2 ♂, 1 ♀. Between Tokyo, Nikko and Kyoto, (Dr. H. C. Wood), 1 ♂, 5 ♀. Sapporo, Ishikari, December, 1896, (M. Matsumura), 1 ♀.

Had we not a topotypic example of *longipennis* from Matsumura we would have been unable to raise this name to specific rank with any degree of certainty, as Shiraki proposed it for what he supposed to be merely the macropterous form of *sapporensis*, describing only the presence of fully developed organs of flight and the naturally resultant obtuse-angulate production and widening caudad of the pronotal disk.

Not only is *longipennis* separable by these features but also by the paler occiput, weaker post-ocular bands, pale tegmina, more maculate caudal tibiae and yellowish caudal femora.

Unfortunately no males of *sapporensis* are before us. Their cerci are described as short.[15] In the males of *longipennis* we find the furcula represented by two short black fingers. The cerci are yellowish, slender, as long as the supra-anal plate,

[14] This record was based on the material listed here, collected by Dr. Wood.

[15] Given as 7 mm. by Shiraki for *sapporensis*, probably for .7 mm.

tapering to the aciculate apex and almost straight. The subgenital plate is entirely yellowish, with acute apex well produced.

The measurements are as follows. Length of body, ♂, 21.8 to 23; ♀, 29.8 to 31: length of pronotum, ♂, 4.7 to 5.2; ♀, 5.9 to 7: caudal width of pronotal disk, ♂, 3.1 to 3.2; ♀, 4.7 to 4.8: length of tegmen, ♂, 19 to 20.4; ♀, 25.8 to 30: length of cercus, 1.2: length of caudal femur, ♂, 11.5 to 12.8; ♀, 15 to 15.8 mm.

Podisma sapporensis Shiraki

1910. *Podisma sapporense* Shiraki, Acrididen Japans, p. 77. [♂, ♀; Ziosankei and Sapporo, Japan.]

Sapporo, Ishikari, December, 1896, (M. Matsumura), 1 ♀.

In this specimen the occiput, very broad post-ocular bands which are continued to the abdominal apex, pronotal sulci and medio-longitudinal carina (these very finely), tegmina, genicular areas of the caudal femora, bases of the caudal tibiae and the apices of the spines and spurs are black. The insect is elsewhere yellowish olivaceous, the caudal tibiae with a bluish tinge and showing a slight paler proximal annulus.

Length of body, 25.2; length of pronotum, 6.3; caudal width of pronotal disk, 4.9; exposed length of tegmen, 2.4; width of tegmen, 1; length of caudal femur, 12.8 mm.

Podisma subaptera new species

1902. *Podisma dairisama* ? Rehn, Proc. Acad. Nat. Sci. Phila., 1902, p. 636. [♂, Japan.][16]

1910. *Podisma fauriei* Shiraki (not *Pezotettix fauriei* Bolivar, 1890), Acrididen Japans, p. 73. [(Juv.) ♂ [nec ♀ ?], ♀; Gifu, Japan.]

The male genitalia and minute, vestigial tegmina and wings are apparently striking differences which serve to distinguish this insect from the other Japanese species of *Podisma*.

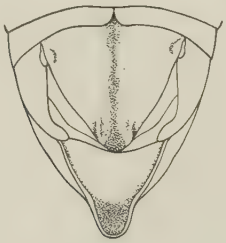
To *P. fauriei* (Bolivar) the nearest relationship exists, that insect, described from a female, apparently differing in the decidedly larger size, larger vestigial tegmina (which probably cover the vestigial wings) and conical prosternal spine. The same differences are shown by the described pair of *P. dairisama* Scudder, which we have placed above as a probable synonym of *fauriei*. The male of *dairisama* apparently has, in addition,

[16] Based on the specimen here described.

proportionately decidedly shorter antennae and cerci more sharply bent inward distad.

Type.—♂; Region between Tokyo, Nikko and Kyoto, Japan. (Dr. H. C. Wood.) [Acad. Nat. Sci. Phila., Type no. 5410.]

Size medium, form moderately slender for the genus. Fastigium strongly declivent, shallowly concave, this becoming a weak but distinct sulcation between the eyes. Frontal costa moderately sulcate throughout, showing slight widening between the antennae. Eyes large and prominent, about twice as long as the infra-ocular sulcus. Antennae elongate, nearly as long as the caudal femur. Pronotum subcylindrical, sulci very weak but cutting broadly the feeble medio-longitudinal carina; surface smooth, the metazona alone very feebly impresso-punctulate; distance from cephalic margin to first sulcus equal to length of metazona; caudal margin of disk almost transverse, a trace of median emargination suggested. Tergites showing a fine medio-longitudinal carina. Tegmina represented by minute, oval pads, their apices projecting briefly beyond the pronotum. Vestiges of wings present, situated just beyond the tegminal apices and smaller than the exposed portion of the tegmina.



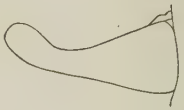


Fig. 1.—*Podisma subaptera* new species. Male. *Type.* Dorsal view of apex of abdomen. (Much enlarged.)

Fig. 2.—*Podisma subaptera* new species. Male. *Type.* Lateral view of cercus. (Greatly enlarged.)

Furcula represented by mere broad convexities of the tergite preceding the supra-anal plate, on each side of a weak obtuse-angulate median emargination. Supra-anal plate triangular with apex rounded, with a broad but shallow medio-longitudinal sulcus and the lateral portions feebly concave; a slight thickening on each margin opposite the cerci and an elongate submarginal thickening near the apex on each side. Subgenital plate small, convex-conical, distal portion produced meso-dorsad, the apex of this production under the lens seen to be sharply rounded. Caudal femora with medio-dorsal carina produced at apex in a very minute triangular projection; ventral margin of genicular lobes moderately convex though showing weak angulation.

Caudal tibiae with nine and ten ventro-external spines; the equal pair of internal spurs twice the length of the equal pair of external spurs. Third joint of caudal tarsus with portion to claws equal to combined length of the first two joints, arolia very large.

The two males before us are apparently discolored. In these the body is yellowish brown with a faint greenish tinge, the dorsum slightly darker. A broad post-ocular band of black is continued to the caudal portion of the abdomen, where it becomes interrupted at the intersections of the tergites. In spite of the fact that the vestiges of the tegmina and wings lie in this band, they are yellowish brown; the tegmina alone showing a trace of black on the costal margin so weakly that it might be supposed to be merely the body coloring showing through a more transparent portion. In addition the distal pre-genital tergites are marked with blackish, particularly in the area of the furcula, as are the lateral portions of the supra-anal plate, the free margin of the subgenital plate, all of the genicular areas of the caudal femora, the base and immediate apex of the caudal tibiae and the apices of its spines and spurs.

Fresh material alone can show whether or not the caudal limbs are brilliantly colored in life as in *P. mikado* (Bolivar), or are actually as described, the latter a condition closely approaching what is apparently the normal coloration in *P. longipennis* Shiraki.

This uncertainty as to the living coloration constitutes one of the major difficulties in properly assigning the names proposed for the Japanese species of *Podisma*.

The measurements of the type are given first. Length of body, 18.7 and 18; length of antenna, 10.8 and 10.8; length of pronotum, 4.3 and 4.3; caudal width of pronotal disk, 2.9 and 2.9; exposed length of tegmen, .7 and .5; width of tegmen, .6 and .6; length of cercus, 1.8 and 1.8; length of caudal femur, 10.9 and 11 mm.

In addition to the type, a paratypic male, bearing the same data, is in the collection of the Academy.

Euprepocnemis shirakii Bolivar

1914. *Euprepocnemis shirakii* Bolivar, Trab. Mus. Nac. Cien. Nat., Madrid, Ser. Zool., no. 20, p. 11. [♂, ♀; Yokohama, Japan.]

Previous to Bolivar's discussion this species had been recorded from Japan as *E. plorans* (Charpentier).

Nishigo, Uzen, 30 ♂, 30 ♀. Yokohama, Musashi, 1 ♂, 4 ♀. Kyoto, Yamashiro, 4 ♂, 3 ♀.

Bolivar's comparison of this insect with *plorans* omits several important features. Not only is the vertex of *shirakii* entirely without a medio-longitudinal carina, the pale borders of the pronotal disk narrower and the male cerci spatulate distad, but the following characters aid further in distinguishing these superficially somewhat similar, but actually very distinct species. Male supra-anal plate narrowing evenly distad to the sharply rounded apex, not narrowing so that in distal portion the lateral margins are much more nearly transverse. Male subgenital plate with apex more sharply rounded. Form slightly less robust. Marginal field of tegmina lacking a conspicuous buffy streak (along its internal margin in proximal portion in *plorans*). Tegmina more heavily flecked distad. Caudal tibiae with suffusion of brown before and after the buffy annulus proximad (these suffusions apparently usually blue or bluish in *plorans*). Caudal femora normally with transverse dark dorsal bars weakly but distinctly indicated, the external portion of the ventral surface tinged with orange. Caudal tarsi proportionately shorter, in the male considerably less than half as long as the caudal tibia.

Traulia ornata ornata Shiraki

1910. *Traulia ornata* Shiraki, Acrididen Japans, p. 68. [♂, ♀; Formosa.]

Loo Choo Islands, 2 ♂.

Unlike the Formosan material of this species described by C. Bolivar,[17] these males have small meso-proximal annuli of yellowish buff on the caudal tibiae. They also show a lesser caudal femoral length than the minimum given by Shiraki or Bolivar.

Exposed length of tegmen, 7 and 7.2; length of caudal femur, 14.7 and 14.6 mm.

[17] Rev. R. Acad. Ciencias Exactas Fis. Nat. Madrid, xv, p. 621, (1917).

STUDIES IN THE DIPTEROUS FAMILY ORTALIDAE, WITH DESCRIPTIONS OF NEW SPECIES, MOSTLY FROM NORTH AMERICA

BY E. T. CRESSON, JR.

This paper is the result of intermittent studies of material in the collection of the Academy of Natural Sciences of Philadelphia, and of collections sent in for determination by the University of Kansas through Dr. S. J. Hunter, and by Cornell University through Dr. J. C. Bradley. Unless otherwise mentioned within brackets, i. e. [ ], the material is in the Academy's collection.

Rivellia vanderwulpi new species

? 1898. *Rivellia conjuncta* Van der Wulp, Biol. Cent.-Amer., Dipt., II, p. 383, pl. x, fig. 11, (nec Loew 1872).

On comparison with specimens of *conjuncta* Loew from the eastern United States, I find this a Mexican form which seems to be that determined by Van der Wulp as Loew's species, but showing several points of difference which I consider of specific importance.

Head broader; frons likewise with very narrow pruinose orbits, which in *conjuncta* are broad and conspicuous; epistomal margin not polished. Fourth vein is not bowed into the discal cell before the anterior crossvein; the basal infuscation which crosses fifth vein is more arcuate, leaving a hyaline spot in base of discal cell. Pile on first abdominal segment pale, not black as in *conjuncta* with which it otherwise agrees.

Type.— ♀ ; Guadalajara, Mexico, July 24, 1901, (McClendon), [A. N. S. P., no. 6296].

Rivellia basilaris Coquillett

1900. *Rivellia basilaris* Coquillett, Journ. N. Y. Ent. Soc., VIII, p. 21.

This is apparently a western species. It has a wing pattern similar to *conjuncta* Loew, but the second band is free from the third; the legs are pale.

A specimen from Sand Hills, Nebraska, July, [Kansas], has the thorax and abdomen rufous, but otherwise I see no material difference from specimens I have from Montana.

Rivellia viridulans Robineau-Desvoidy

1830. *Rivellia viridulans* Robineau-Desvoidy, Myod., p. 729.

Large, entirely black species, except that the articulations of the legs are more or less pale. Wing bands separated. This and the next species have the wing bands separated or at most the second and third are slightly connected at posterior crossvein as in *quadrifasciata*.

Material examined from:

New York: Ithaca, July, [Cornell]. Massapequa, Long Island, July, (W. T. Davis).

New Jersey: Brown's Mills Junction, June, (Harbeck). Riverton, June, (Painter). Trenton, July, (Harbeck).

Pennsylvania: Ardmore, June, (Skinner). Fairmount Park, Philadelphia, May, (Haimbach).

Maryland: Mountain Lake, Giles County, June, (Calvert).

Georgia: Black Rock Mountain, [Cornell].

Illinois: Northern Illinois.

Nebraska: Fremont, July.

Rivellia variabilis Loew

1873. *Rivellia variabilis* Loew, Mon. Dipt. N. Am., III, p. 90, pl. 8, fig. 6.

This species is entirely ferrugineous or rarely the abdomen is black; legs pale with hind tibiae often darker. I consider *R. pallida* Loew a small, paler form.

The following localities are represented in the material before me:

New York: Ithaca, July, [Cornell].

New Jersey: Anglesea, June to July, (Harbeck). Clementon, May, (Harbeck). Pemberton, July, (Harbeck). Wildwood, June, (Harbeck).

Pennsylvania: Germantown, July, (Harbeck). Glenside, June, (Harbeck). Hunters Run, (Daecke). Hazleton, July, (Dietz). Manayunk, (Johnson). Swarthmore, June, (Cresson).

South Carolina: Manning, May, (Stone).

Georgia: Billy's Island, Okefenokee Swamp, June, (Bradley); Black Rock Mountain, May, (Bradley); Rabun Bald, August, (Bradley); De Witt; Tybee Island, July, (Bradley); [all Cornell].

Nebraska: Fremont.

Rivellia flavimana Loew

1873. *Rivellia flavimana* Loew, Mon. Dipt. N. Am., III, p. 92, pl. 8, fig. 7.

Black, more or less metallic tinged; fore legs pale; middle and hind femora and their tibiae darker; fore legs rarely brownish; cheeks generally twice as broad as third antennal segment. Wing bands complete; first attaining fourth vein; second attaining discal cell, but not connected with third; latter attaining fifth vein. There should not be any confusion with *quadrifasciata* which has all femora pale, never dark, and the abdomen often reddish.

Localities represented:

NEW YORK: Ithaca, June, [Cornell].

NEW JERSEY: Anglesea, June, (Harbeck). Pemberton, July, (Harbeck). Riverton, June, (Harbeck).

PENNSYLVANIA: Fern Rock, Montgomery County, June, (Harbeck).

WISCONSIN: no locality.

Rivellia quadrifasciata (Macquart)

1835. *Herina quadrifasciata* Macquart, Hist. Nat. Ins., Dipt., II, p. 433.
1873. *Rivellia quadrifasciata* Loew, Mon. Dipt. N. Am., III, p. 90, pl. 8, fig. 5.

Thorax black, metallic tinged; abdomen tawny, sometimes dark in part; face rufous; legs pale except hind tibiae which are darker. Wing bands well developed, but second band generally connected with third at posterior crossvein. This species may often be confused with *flavimana*, but the femora are never dark in the present form.

Following localities represented:

NEW YORK: Ithaca, [Cornell].

NEW JERSEY: Ashland, June, (Harbeck). Clementon, May, (Harbeck). Manahawkin, August, (Harbeck). Medford, August, (Stone.) Riverton, June, (Harbeck).

PENNSYLVANIA: Philadelphia.

NORTH CAROLINA: Lake Waccamaw, [Cornell].

SOUTH CAROLINA: Manning, May, (Stone).

GEORGIA: Bainbridge, July; Billy's Island, June; Spring Creek; St. Simon Island; Thalman; (all Bradley), [all Cornell].

ILLINOIS: Peoria, [Cornell].

NEBRASKA: Fremont, [Cornell].

Rivellia cognata Cresson

1919. *Rivellia cognata* Cresson, Proc. Acad. Nat. Sci. Phila., 1919, p. 191.

Similar to *flavimana* but the legs entirely yellow with the hind tibiae brown, never black. Differing from *quadrifasciata* in having first basal cell hyaline, seldom obscured basally; abdomen entirely black. Recent examination of additional material in this genus has located several specimens which show *quadrifasciata* tendencies in that the infuscation of first basal cell is more or less distinct, but on the other hand these have the abdomen always black; the species also averages smaller than *quadrifasciata*, and there is less metallic tinge on the thorax.

Localities represented:

New York: Ithaca, July, [Cornell].

New Jersey: Medford, August, (Stone). Trenton, May to July, (Harbeck).

Pennsylvania: Germantown, August, (Harbeck). Manayunk. Swarthmore, May to July, (Cresson).

South Carolina: Manning, May, (Stone).

Georgia: [Cornell].

Florida: St. Petersburg, August, (Bradley), [Cornell].

Wisconsin: Beaver Dam, June, (Dietz).

Rivellia micans Loew

1873. *Rivellia micans* Loew, Mon. Dipt. No. Am., III, p. 94.

The specimens here considered as belonging to this species I had confused with *quadrifasciata* and *cognata*. The metallic tinge seems to vary considerably, but as with other species it is generally discernible, and those possessing such coloration usually have a more shining surface. The first basal cell is hyaline or slightly infuscated basally,[1] and the second band is almost parallel with the third, which character is quite noticeable as differing from that in the two above mentioned species. The specimen from Kansas is as large as those under *quadrifasciata* and very strongly metallic; the others are smaller and have some red at base of abdomen.

Localities represented:

[1] I herein dissent from Loew's note under his description. He may have erred in the use of "R. micans" instead of "R. flavimana."

Dakota.
Kansas: Barton County, (Hunter), [Kansas].
Texas: Galveston, May, (Snow), [Kansas].
California.

Rivellia occulta Van der Wulp

1898. *Rivellia occulta* Van der Wulp, Biol. Cent.-Amer., Dipt., II, p. 382, pl. 10, fig. 8.

Before me are specimens from Arizona which agree in most respects with specimens from Mexico and Costa Rica, and may be considered as belonging to this species. We would place this species in the *metallica*-group on the basis of having the costal cell hyaline, but the bands are more transverse, less oblique than is typical with that group and the body shows no metallic tints. The second band is somewhat arcuate or broken at fourth vein; all attain the fifth vein.

Localities represented:
Arizona: Huachuca Mountains, August, (Skinner).
Mexico: Guadalajara, July, (McClendon).
Costa Rica: La Verbena, near San José, May, (Calvert).

Rivellia metallica (Van der Wulp)

1867. *Herina metallica* Van der Wulp, Tijd. v. Ent., x, p. 154, pl. 5, fig. 10.

I have retained this name for those specimens having a recessive wing pattern, with the costal cell hyaline at least to beyond humeral crossvein, and the bands attaining, at most, fifth vein. The thorax and abdomen are more or less metallic.

Localities represented:
New York: Ithaca, June to August, [Cornell].
Delaware.

Rivellia brevifasciata Johnson

1900. *Rivellia brevifasciata* Johnson, Ent. News, XI, p. 326.

This species belongs to the *metallica*-group, and may ultimately prove to be a synonym of *metallica*. However, we may retain the name for those specimens having the wing pattern still more reduced, so that the first and second bands at most merely attain the fourth vein, and are often represented only by isolated fuscous spots at the costa and on third vein. Otherwise the specimens are apparently identical with my series of *metallica*.

Localities represented:

New Jersey: Clementon, May, (Harbeck).

Georgia: Austell, August, [Cornell]; Billy's Island, Okefenokee Swamp, June; Spring Creek, Decatur County, June, (Bradley); Tybee Island, August; Waycross, May; [all Cornell].

Tephronota ruficeps (Van der Vulp)

1867. *Herina ruficeps* Van der Wulp, Tijd. v. Ent., x, p. 156, pl. 5, fig. 11.
1873. *Tephronota humilis* Loew, Mon. Dipt. No. Am., III, p. 123, pl. 8, fig. 24.
1902. *Tephronota ruficeps* Johnson, Ent. News, XIII, p. 143.

This species resembles some *Euxesta* in the wing markings, but has the thorax opaque. The wing markings of the specimens I have seen of this species are generally broader and more distinct than is figured by Van der Wulp, agreeing more with Loew's figure. Can it be that *ruficeps* and *humilis* are not synonymous, and that the specimens before me are not *ruficeps?* The species was originally described from Wisconsin, but Johnson says "the species seems to be confined to the states bordering on the Atlantic from New York to Florida," and cites localities in New Jersey, Virginia, Georgia, Florida, and Texas.

Before me are specimens from Kansas which do not differ materially from others from the localities noted below, but the entire series shows some variation in the width of the wing markings, although they are always broader than is figured by Van der Wulp.

Localities represented:

New York: Yaphank, Long Island, July, (Davis). Mud Creek, Tompkins County, June, [Cornell].

New Jersey, Manahawkin, August, (Harbeck).

Pennsylvania: Fern Rock, Montgomery County, June, (Harbeck).

South Carolina: Manning, May, (Stone).

Kansas: Douglas County; Linn County, (Beamer); [all Kansas].

Melieria obscuricornis (Loew)

1873. *Ceroxys obscuricornis* Loew, Mon. Dipt. No. Am., III, p. 126, pl. 8, fig. 20.
1873. *Ceroxys ochricornis* Loew, Mon. Dipt. No. Am., III, p. 126, pl. 8, fig. 21.
1905. *Melieria obscuricornis* Aldrich, Cat. Dipt. No. Am., p. 592.

This species simulates *Ortalis cana* in that the costal cell is entirely hyaline. From *cana* it may be distinguished by the

apical and subapical clouds being separated by a large hyaline area, and in that all the femora are pale. From *ochricornis*, I cannot find any satisfactory differentiation; the margining of the abdominal segments seems to vary considerably, which fact leads me to propose the above synonymy. The frons in this species are somewhat bloated with indistinct white pruinose orbits.

Before me are seven specimens from CANADA: Aweme, Manitoba, June, (Criddle); Warman, Saskatchewan, July, (Skinner).

Melieria cana (Loew)

1858. *Ortalis cana* Loew, Berl. Ent. Zeit., II, p. 374.
1873. *Ceroxys cana* Loew, Mon. Dipt. No. Am., III, p. 128, pl. 8, fig. 22.
1905. *Melieria cana* Aldrich, Cat. Dipt. No. Am., p. 592.

Here the frons is less turgid than in *obscuricornis*, and the orbits are distinctly white pruinose. My series shows no trace of marginal coloration on the abdominal segments, the costal cell is entirely hyaline, and the apical cloud is fused with that one at end of second vein.

Six specimens from IDAHO: Springfield, July, (Skinner).

Melieria occidentalis Coquillett

1904. *Melieria occidentalis* Coquillett, Inv. Pac., I, p. 29.

This western species is distinguished by the infuscated costal cell, in which respects it simulates our eastern *similis*, but from which it is separated by the characters I give under that species. The apical and subapical clouds are more or less fused; frons flattened, with distinct white orbits, and the abdominal segments at most faintly margined.

Localities represented by sixteen specimens:
KANSAS: Grove County, (Williams), [Kansas].
MINNESOTA: Beaver River, Lake County, August, (Stone).
COLORADO.
WYOMING: Cheyenne, August, [Kansas].
IDAHO: Springfield, July, (Skinner).
CALIFORNIA: Riverside, June. San Diego County.

Melieria similis (Loew)

1873. *Ceroxys similis* Loew, Mon. Dipt. No. Am., III, p. 122, pl. 8, fig. 23.
1905. *Melieria similis* Aldrich, Cat. No. Am. Dipt., p. 592.

This, our only eastern species of the genus, has its counterpart in the western *occidentalis*. The costal cell is infuscated apically; the apical and subapical clouds are more or less separated; the frons rather bloated, with indistinct white pruinose orbits; abdominal segments distinctly margined.

Two specimens from:

NEW HAMPSHIRE: Hanover, (Weed).

NEW YORK: Ithaca, July, [Cornell].

Tetanops luridipennis Loew

1873. *Tetanops luridipennis* Loew, Mon. Dipt. No. Am., III, p. 119, pl. 8, fig. 17.

Head turgid, having a bloated appearance, as broad as high or broader; eyes not higher than cheeks; frons broad at vertex, one-third width of head, about as broad as long, rarely longer; lateral vertical spot generally absent; facial and buccal orbital spots absent or latter faint and brown. The vertical and buccal spots are not mentioned by Loew. The species seem to be confined to the United States east of the Rocky Mountains.

Localities represented:

PENNSYLVANIA: Lansdale, July, (Cresson). Point Pleasant, August, (Harbeck). Swarthmore, July, (Cresson).

NEW JERSEY: Trenton, July, (Harbeck).

KANSAS: Chautauqua County; Cowley County; (all Beamer), [all Kansas].

? Tetanops rufifrons Van der Wulp

1898. *Tetanops rufifrons* Van der Wulp, Biol. Cent.-Amer., Dipt., II, p. 391, pl. 10, fig. 25.

Before me are three specimens from East Las Vegas, New Mexico, June, (Viereck), [A. N. S. P.]; Magdalena Mountains, New Mexico, [Kansas]; and Carr Canyon, Cochise County, Arizona, August, (Skinner), [A. N. S. P.], which may be this species. The head structure is similar to that of the eastern specimens of *luridipennis*, but the vertical angles are brown, the cheek has a distinct black vertical spot nearly reaching oral mar-

gin; third antennal segment infuscated apically. *Rufifrons* was described from Mexico.

Tetanops magdalenae new species

Differing from all known North American species of the genus in having the frons without the characteristic punctiform markings. In the present species the frons is rufous, with a median pale stripe and narrow silvery orbits; the lateral areas are shining, in slight contrast with the median area. The thorax is similar to that of the other species, but the abdomen is without the distinct punctiform markings.

Black; head tawny to yellow with lateral areas of frons and small foveal spot rufous; proboscis, small ocellar and buccal spot, upper lateral and central occipital black, sometimes lateral vertical spot also present; knees, middle and hind tibiae, and tarsi, tawny. Halteres pale yellow. Wings yellowish hyaline, veins pale; clouds at or before apices of first and third veins. Head except median third of frons, humeri, scutellum and abdomen more or less shining. Thorax densely cinereous, especially above, with numerous black punctiform markings.

Head as in *luridipennis* but less turgid, high as broad; eyes large, twice as high as cheeks; frons one-fourth width of head, distinctly longer than broad; third antennal segment twice as long as second; the latter twice as long as broad. First posterior cell scarcely narrowed apically; fourth vein not curved apically.

Length.—4 to 5 mm.

Type.—♀; Magdalena Mountains, New Mexico, (Snow), [Collection of University of Kansas]. *Paratypes.*—1 ♂, 1 ♀; topotypical.

Tetanops vittifrons Van der Wulp

1898. *Tetanops vittifrons* Van der Wulp, Biol. Cent.-Amer., Dipt., II, p. 391, pl. 10, fig. 24.

Before me are two females from Guadalajara, Mexico, July, (McClendon), which seem to belong to this species. The head is less turgid than in *luridipennis*, higher than broad; eyes higher than cheeks; frons one-fourth width of head, distinctly longer than broad; lateral vertical and buccal spots distinct, and in addition there are distinct facial orbital spots.

Ortalis latiuscula (Loew)

1873. *Anacampta latiuscula* Loew, Mon. Dipt. No. Am., III, p. 130, pl. 8, fig. 19.

1911. *Ortalis latiuscula* Hendel, Wien Ent. Zeit., XXX, p. 21.

This seems to be a valid member of the genus *Ortalis* as now understood, or of *Anacampta* Loew, as understood prior to 1911.

Localities represented by five specimens:

California: Berkeley, February, (Cresson). Ocean View, May. Salt Marsh, Alameda, May, (Cresson).

Ortalis snowi new species

This species differs from other North American species by having the thorax cinereous, not shining and the wings without distinct markings. Similar to *pyrrhocephala* in general habitus.

Head and members rufous to yellow; upper lateral occiput black; broad frontal orbits, entire parafacial area, facial carina, cheeks except a vertical stripe, and occipital orbits, white pruinose. Thorax, abdomen except genital segments, legs except apices of femora and bases of tibiae, black. Thorax including humeri, scutellum rather densely, pale ochreous pruinose with three approximate median mesonotal stripes of denser dusting; abdomen and legs more shining. Wings whitish; veins pale; apex very faintly infuscated.

Length.—5 to 6 mm.

Type.—♂; Hamilton County, Kansas, 3350 feet altitude, (F. H. Snow), [Collection of University of Kansas]. *Paratypes.*—1 ♂, 1 ♀; topotypical. 1 ♀; Clark County, Kansas, May, (F. H. Snow), [Univ. of Kansas].

Ortalis pyrrhocephala (Loew)

1876. *Anacampta pyrrhocephala* Loew, Zeit. f. Ges. Wissen. Berlin, xlviii, p. 335.

1911. *Ortalis pyrrhocephala* Hendel, Wien. Ent. Zeit., xxx, p. 21.

1914. *Tetanops carbona* Cresson, Ent. News, xxv, p. 458.

I am not satisfied that this is congeneric with *Anacampta latiuscula* Loew, but cannot at present suggest any structural characters of differentiation which may be considered of generic value, excepting possibly the non-excised third antennal segment and the straight ultimate section of fourth vein. The wings are not banded; the maculation limited to costal spots at apices of first and second veins. Hendel in 1911 was aware of this differentiation but did not consider it of generic value. I feel sure of the synonymy of *Tetanops carbona*. The association with the species of *Tetanops* seemed more logical than with *Anacampta latiuscula*. I had overlooked Loew's species and Hendel's paper.

Twelve specimens are before me:
NEVADA: Ormsby County, July, (Baker).
WYOMING: Carbon County, [as *Tetanops carbona* Cresson].
CALIFORNIA: Saugus, Los Angeles County, May, (Jones).
BRITISH COLUMBIA: Cranbrook, June, (Garrett).

Ortalis stigma Hendel

1911. *Ortalis stigma* Hendel, Wien. Ent. Zeit., xxx, p. 21.

This is certainly congeneric with, but apparently quite distinct from, *Anacampta pyrrhocephala*.

Two specimens from:
BRITISH COLUMBIA: Cranbrook, June, (Garrett).
COLORADO: Manitou Park, (F. H. Snow), [Kansas].

PSAIROPTERA Wahlberg

1838. *Psairoptera* Wahlberg, K. Svenska Vet. Akad. Handl., 1838, p. 18.
1839. *Homalocephala* Zetterstedt, Ins. Lapp., p. 749. [Syn. by Zetterstedt, 1840.]
1846. *Psaeroptera* Agassig, Nom. Zool., Index Univ., p. 310. [Emend.]

This genus was erected for *bimaculata*, *biumbrata* and two other species from northern Europe. In the same or next year Zetterstedt proposed his genus for a species from Finland, *albitarsis*. The priority of *Psairoptera* is probably due to the fact that Wahlberg's paper appeared slightly before that of Zetterstedt, early in 1838, as it was the first article in the 1838 Handlingar; while the Diptera part of the Insecta Lapponica probably came out late in 1838 or early 1839. Sherborn gives 1838 for pages 1–867 of the latter.[2] However, Zetterstedt in his Diptera Scandinaviae (VI, p. 2263, (1840)), cites *Psairoptera* in preference to his *Homalocephala*, but retains his species *albitarsis* in preference to *biumbrata* Wahlberg, which he cites as a synonym. All subsequent authors have followed this latter citation, but if *Psairoptera* has priority over *Homalocephala*, surely *biumbrata* must have priority over *albitarsis* if the two are synonymous, and no preoccupation is involved, which latter seems not to be the case.

In the present writing I am considering *Psairoptera* as having priority, and as the European species are not of immediate interest, I will leave the matter as stated above.

[2] Index Animal., Sect. II, p. cxxxi, (1922).

The genus does not seem to have been recognized from North America except as undescribed species reported from the White Mountains, New Hampshire, by Mrs. Slosson,[3] and Dr. Aldrich[4] reports having seen specimens from Kansas. The species here described do not seem to be congeneric with *Hiatus* Cresson.

Psairoptera similis new species

This species has much the appearance of those in the genus *Seiroptera*, but it is easily differentiated by the transverse, black head with white face and cheeks. It is, however, apparently very similar to the European *P. apicalis* Wahlberg.

Black; anterior margin of frons, base of antennae, facial orbits opposite antennae, apex of tibiae, and base of tarsi, tawny; face including buccal orbits and squamae, white. Halteres black. Wings hyaline; veins pale; costa, first vein, costal cell basad of humeral crossvein, and beyond apex of auxiliary vein, black; a spot including apex of second and third veins, brown. Shining to polished, with white bloom on occiput and thorax.

♂. Head twice as broad as high, longer than high; eyes horizontal, rather angular at antennal orbits, frons as broad as long, convex and oblique in profile, micro-setulose; inner and outer verticals, and post-verticals distinct; ocellars minute. Face concaved in profile, not longer than antennae; cheeks one-third height of head. Third antennal segment longer than broad, rounded apically; arista bare. Thorax elongate with fore coxae not attaining base of middle ones by one-half the length of former; mesonotum convex, setulose; one to two dorso-centrals near posterior margin; three bristles at post-lateral angles; two noto-pleurals; no meso-pleurals, prothoracicals, nor sternopleurals. Scutellum broadly triangular with two apicals and two subdorso-laterals. Wings long; first vein bristly; third vein bare; second, third and fourth veins parallel; anterior crossvein at middle of discal cell and nearly parallel to posterior crossvein, but latter forming slight angle with fourth vein; anal cell not produced, anal crossvein at right angle with sixth vein.

Length.—3 to 5 mm.

♀. Similar, with basal segment of ovipositor nearly broad as long, broader than fourth abdominal segment, subrhomboidal in outline.

[3] Ent. News, VIII, p. 239, (1897).

[4] Cat. No. Am. Dipt., p. 594, (1905).

Type.—♂; Star City, Saskatchewan, Canada, (H. Skinner), July 20, 1907, [Acad. Nat. Sci. Phila., no. 6285]. *Paratypes.*—3 ♀; topotypical.

Psairoptera skinneri new species

This species may not be congeneric with *similis*. The posterior crossvein is less acutely angular with the fourth, and the anal cell is distinctly produced.

Black, generally shining; head excluding occiput above, vertical orbits, ocellar tubercle, antennae, palpi, halteres, fore coxae and their femora, middle and hing legs except fore apical tarsal segments, and wing veins, yellow. Fore tibiae more or less pale above, and middle and hind tibiae with dark preapical ring. Black portion of head, thorax and abdomen shining, metallic tinged; of head and thorax more or less white pruinose. Face white, which color extends as a silver stripe along buccal orbits; frons slightly subopaque. Apical portion of arista, black. Wings hyaline with black spot at apices of first and second veins, the latter more or less including apex of third veins.

Frons longer than broad, slightly depressed medianly, sparingly setulose; no distinct fronto-orbitals, but two reclinate frontals, present. Face and cheeks as in *similis* but shorter in comparison with height of head; thorax and its bristles similar to *similis*, but with the addition of distinct mesopleural and sternopleural bristles. Scutellum about as long as broad. Wings long and narrow; costal section between auxiliary and first veins as long as between humeral crossvein and auxiliary vein; second, third and fourth veins slightly converging; two last sections of fourth vein subequal; posterior crossvein perpendicular with fourth and parallel with anterior crossvein; anal cell produced, but not as much so as in *Pseudotephritis*.

Length.—3 mm.

Type.—♂; Guatanamo, Cuba, (H. Skinner), February 10, 1914, [Acad. Nat. Sci. Phila., no. 6286]. *Paratypes.*—2 ♂; topotypical.

Acrosticta rufiventris Hendel

1910. *Acrosticta rufiventris* Hendel, Gen. Ins., Ulidiinae, p. 52, note 2, pl. 4, fig. 101.

To this species I refer those specimens having the mesonotum pruinose, with dilute punctiform design; frons broad as eye, shining, rugulose above; occiput black, metallic tinged. Face concaved, with, at most, a broad flat carina, white pruinose.

Abdomen mostly red; third segment as long as first and second together. Stigma large, nearly as long as auxiliary vein. Legs pale, with dark hind tibiae. There are two dorso-centrals, but no prescutellars.

Specimens are before me from:

FLORIDA: Charlotte Harbor, [Kansas].

TEXAS: Galveston, May to June, (F. H. Snow), [Kansas].

CALIFORNIA: Coronado, June.

Acrosticta similis new species

Black, metallic tinged; frons except vertical angles and ocellar region, face and cheeks except middle of former, antennae, coxae, femora, base of middle and hind tarsi, pale. Halteres and squamae whitish; fore tibiae and tarsi black; middle and hind tibiae and apex of tarsi, brown. All metallic surfaces more or less white pruinose except scutellum and metanotum, the former granulose, latter polished; mesonotum with a dark transverse band behind suture; frons and facial orbits white pruinose, middle of former transversely rugose.

Frons narrow, two thirds as broad as eye; face acutely concaved, no carina; cheeks as broad as third antennal segment; epistoma strongly concaved, revealing the well developed metallic tinged clypeus. Two dorso-centrals; prescutellars present. Stigma much shorter than the auxiliary vein.

Length.—3 mm.

Type.—♂; Portland, Jamaica, [Collection of University of Kansas]. *Paratypes.*—2 ♀; topotypical.

This species is apparently similar to *scrobricularis* in general color, but the femora are pale, although in some cases tending to brown.

Euxesta remota new species

Near *stigmatias* Loew in having the lunule velvety black, but the legs are entirely yellow.

Head tawny except the occiput and the velvety black lunule. Thorax, scutellum, abdomen shining, aeneous black; mesonotum somewhat pruinose; legs tawny, with hind tibiae and tarsi darker. Squamae and knob of halteres white. Wing maculation similar to figure of *Chaetopsis angustata* Hendel,[5] but spot in the first posterior cell is larger and extends into the second cell. Clypeus, middle of face, palpi, and antennae tawny. Frons

[5] Gen. Ins., Fasc. 106, pl. 11, fig. 40.

nearly as broad as eye, with well developed bristles. Basal segment of ovipositor nearly one-half length of abdomen.

Length.—5 mm.

Type.— ♀ ; Havana, Cuba, (Baker), [Univ. of Kansas].

Euxesta notata (Wiedermann)

1830. *Ortalis notata* Wiederman, Auss. Zweifl. Ins., II, p. 462.

1867. *Euxesta notata* Loew, Berl. Ent. Zeit., XI, p. 300, (Cent. II, p. 9).

This species has been previously recorded only from the eastern part of the United States, with the exception of probably a few instances, and these may have been based on misidentifications. However, before me are two females from Cloudcroft, New Mexico, May 22 and 24, 1902, (Viereck), which are almost identical with the eastern specimens, differing in being smaller (3 mm.), frons and lateral part of face dark brown; abdomen entirely black; legs black except base of middle and hind tarsi; costal cell basally infuscated.

Euxesta nitidiventris Loew

1873. *Euxesta nitidiventris* Loew, Mon. Dipt. No. Am., III, p. 157.

Similar to *minor* but larger; frons not so shining, with distinct white pruinose band across middle; face medianly below, and clypeus, shining, metallic black. The medial costal spot of wings is ante-stigmal in position, not at the stigma, and is evanescent before fourth vein; apical spot straight, without concaved inner margin at submarginal cell. Legs entirely yellow, except fore tibiae and tarsi which are darker and in some specimens the middle and hind tibiae are also slightly darker; the femora do not show any darkening, except apically in the California specimens, and these also have the apex of abdomen narrowly yellow.

In Hendel's table for *Euxesta*[6] this species runs under the caption which calls for the legs predominantly blackish, which statement is misleading, as Loew expressly states that the femora are "saturate dark yellow." I do not think Hendel correctly visualized this species. The specimens before me are apparently pale varieties of this species and Loew probably had specimens with darker legs.

[6] An. Mus. Nat. Hung., VII, p. 156, (1909).

Localities represented:

KANSAS: Logan County, (Snow), [Kansas]. Clark County, June, (Snow), [Kansas].

CALIFORNIA: Kern County.

Euxesta pulchella Cresson

1906. *Euxesta pulchella* Cresson, Trans. Am. Ent. Soc., XXXII, p. 287, pl. 6, fig. 11.

This species was based on a single female from Alamogordo, New Mexico. Before me is another female from Las Cruces, New Mexico, April 14, [Kansas], agreeing with the type; also a male from Alamogordo, New Mexico, April 8, 1902, (Viereck), [A. N. S. P.], which I had previously[7] determined as *Euxesta notata*, and subsequently had placed in the collection as *nitidiventris* Loew with two of the females from Cloudcroft, mentioned in the paper referred to under *notata*. This Alamogordo male is similar to the type of *pulchella* in all respects except that the abdomen lacks the yellow band. I have no doubt as to these specimens being conspecific. The species has the wings noticeably milky white.

Euxesta magdalenae new species

Similar to *E. pulchella*, but the frons is shining, with at most only narrow, not rounded, white pruinose spots on the orbits, as in that species; the halteres are dark brown and the wings are mostly clear, not milky.

Black; frons except vertical angles and occiput, parafacialia, cheeks, knob of halteres, knees and base of middle and hind tarsi, and third antennal segment, brown. Squamae white. Wings hyaline; extreme base and apex of second posterior cell more or less milky tinged; costal cell, stigma, ante-stigmal spot attaining third vein, also apical spot including marginal, submarginal, and nearly entire apex of first posterior, infuscated to one-half length of ultimate section of fourth vein; apex of costal cell slightly diluted.

Mostly shining to polished, with metallic tinge, latter especially on abdomen; narrow frontal orbital spot, narrow facial orbits, spot between and below antennae, white pruinose; face medianly, lower cheek and clypeus polished black; mesonotum somewhat pruinose; third and fourth abdominal segments subopaque on account of the granulose surface, and is noticeably differently

[7] Trans. Am. Ent. Soc., XXXII, p. 287.

colored (reddish-purple) from the basal segments which are bluish green to bronze. Head broader than high; frons not as broad as eye.

Length.—3.5 mm.

Type.—♂; Magdalena, New Mexico, [University of Kansas Collection].

I have also a female from Wyoming, [Univ. of Kansas], which is apparently conspecific; the abdomen is brilliantly metallic yellow and purple.

Chaetopsis magna new species

A series of large (7 to 8 mm.) specimens are before me from Douglas County, Kansas, June, [Kansas], which are probably distinct from *massyla* Walker and *aenea* Wiedermann of the Eastern States. In addition to the larger size, the abdomen of the female is red or dull crimson, as is also the knob of the halteres. The frons has a frontal and mesofrontal series of fine bristles, five to six in each series. Wing infuscation very intense to the inferior margin; the subapical white band does not attain the costa nor the inferior margin. Legs dark except apex of femora and tarsi. Frons and face reddish brown; third antennal segment black except base.

Type.—♀; Douglas County, Kansas, June, [University of Kansas Collection]. *Paratypes.*—2 ♂, 2 ♀; topotypical.

THE NEARCTIC RHAGOVELIAE (HETEROPTERA; VELIIDAE)

BY J. R. DE LA TORRE BUENO

With the two new Rhagovelias from our Central and Northern States received from Prof. H. B. Hungerford in hand, as well as another from the South received from Mr. C. S. Brimley, a fresh study of our old *Rhagovelia obesa* Uhler and the new *Rh. oriander* Parshley became necessary in order to accurately differentiate the five species. All are of much the same general aspect, except that *rivale* is dull sericeous and *flavicincta* is somewhat the smallest of the five.

There are before me specimens of *Rh. oriander* (paratypes), and *Rh. obesa;* and the type series of *Rh. arctoa, Rh. rivale* and *Rh. flavicincta.* A brief diagnosis has been drawn up of *Rh. oriander* Parshley, and of the form commonly recognized by American hemipterists as *Rh. obesa* Uhler. These five species belong in that section in Champion's key in the Biologia Centrali-Americana[1] which contains species with a straight spur on the posterior tibiae. However, in spite of Champion's suggestion[2] with regard to the status of Uhler's *obesa* and his own *distincta,* the two are different. The antennal proportions are apparently a group character and *distincta* certainly falls within this group; but the character is in consequence not very good to separate these species positively. A good character not noted by Uhler in his two descriptions of *Rh. obesa*[3] is in the hairs arising from the edge of the connexivum of the first abdominal segment, which hairs are ordinarily so matted together as to appear like a long shining black spine, projecting from the posterior angle.

The entire genus calls for a complete revision, with specimens in hand. It is obvious, given the dispersive nature of aquatic Hemiptera in general, that our Gulf, South Atlantic, Mexican border and Pacific States must harbor many of the species re-

[1] Rhynchota, Hemiptera-Heteroptera, II, p. 131.
[2] Op. c., pp. 132, 137.
[3] Proc. Boston Soc. Nat. Hist., XIV, p. 109; Ibid., XIX, p. 434.

corded in the Biologia from Mexico and Central America, as well as many undescribed species, as these present new species would seem to make apparent.

It is to be noted that absolute characters only are used in these descriptions; and that comparisons are on a fixed basis of the proportions of structures within the species and not on a "more or less" scale. The endeavor has been to make these descriptions positive within the species; and not comparative with any other species in things that are pure matters of judgment or personal interpretation of terms.

The reason for basing these species on apterous types is twofold. Of two of the species—*rivale* and *flavicincta*—only wingless individuals are available. The other—and more compelling—reason is that *Rhagoveliae* are normally apterous; and it may be deemed, therefore, that the wingless form is typical of the species, as it is in fact more characteristic and presents better differential structures more abundantly. This also applies to the key. Since certain of the invariable critical characters in di- or polymorphic species—namely, the legs and the antennae—are therein given, it will apply equally well to all forms and both sexes.

It may also be pointed out that since these keys and descriptions were drawn up under the binocular microscope, with an eyepiece micrometer, it is possible that proportions may not be readily perceived with a hand lens, particularly because of the deceptive dimensions depending on form. For example, under the hand lens (× 10) the terminal antennal segment appears quite a bit shorter than segment three, but on measuring with the micrometer, the difference is found to be inappreciable.

The key following will serve to separate the five species herein referred to, as well as the other species occurring from Mexico north, so far as known.

Key to the Rhagoveliae of North America

1. Second segment of posterior tarsi longer than third; hind femora scarcely incrassate in both sexes, not spinose; lead gray in color; estuarine (subgenus *Trochopus* Carpenter); 3.2–3.8 mm. long. (Florida)..... **Rh. (T.) plumbea** Uhler

   Second segment of posterior tarsi shorter than third; hind femora more or less incrassate, at least in the male, spinose; more or less aeneous; fluviatile (subgenus *Rhagovelia* s. str.) 2

2. Second segment of intermediate tarsi much longer than third; pronotum (in winged) obtuse at tip; posterior femora slender and with one long and three or four very short teeth in both sexes; abdomen short; 4 mm. long. (Mexico.)
Rh. tenuipes Champion

Second segment of intermediate tarsi not or very little longer than third; pronotum (in winged or apterous) acute or produced in a spiniform process behind; abdomen moderately long 3

3. Posterior femora slender with one long and three or four very short teeth in both sexes; posterior tibiae straight and obsoletely denticulate; body short; connexivum not markedly reflexed in female. (Mexico.)...**Rh. angustipes** Uhler

Posterior femora more or less incrassate in male; body moderately long; connexivum markedly reflexed in female..... 4

4. Posterior femora strongly incrassate and multidentate; and the posterior tibiae armed with slightly longer teeth beyond the middle in the male; 6 mm. long. (Mexico.)
Rh. varipes Champion

Posterior femora moderately or scarcely incrassate and tibiae very finely, minutely or obsoletely denticulate in the male.. 5

5. Posterior femora moderately incrassate in both sexes; venter depressed at base in male; 5.75 mm. long. (Texas.)
Rh. armata Burmeister

Posterior femora moderately incrassate in male, slender in female; venter not depressed at base in male..... 6

6. Intermediate tibia nearly or quite three times as long as third tarsal segment; 5 mm. long. (Mexico.)
Rh. distincta Champion

Intermediate tibia only twice as long as third tarsal segment, or less..... 7

7. Intermediate tibia twice as long as last tarsal segment (third); connexivum in female not meeting above abdomen; body dull sericeous; edge of connexivum of first segment without long hairs; upper surface of female genital segment pilose; both sexes without a spine on anterior trochanters; length, apterous, 3.3–4.6 mm., winged, 4–4.45 mm.
Rh. rivale new species

Intermediate tibia not twice as long as last tarsal segment (third); connexivum in female meeting above last abdominal segment; males only with a spine on exterior aspect of trochanter; species with more or less of an aeneous luster..... 8

8. Pronotum in apterous male bluntly angulate posteriorly; in female produced and terminating in a long knob; a group of long hairs on each side of the female genital segment, more or less matted together and appearing like a long spine; segment one of antennae not quite twice as long as segment four; connexivum in female without a group of appressed long hairs on the edge of the first segment; male posterior femora twice as thick as intermediate femora; length 3.6–3.7.
Rh. oriander Parshley

Pronotum in apterous rounded, truncate or excavate posteriorly in both sexes; no genital bristles in female; segments one and four of antennae of varying proportions; edge of connexivum of first abdominal segment in female bearing a group of closely appressed long hairs, having the appearance of a long slender spine arising from the posterior angle of the segment, sometimes concealed and lying flat under the reflexed connexivum.....9

9. Connexivum broadly flavous, glabrous; antennal segment one one and one-half times as long as segments three or four; length 3.2–3.85 mm.....**Rh. flavicincta** new species

Connexivum narrowly flavous or orange, more or less hairy; segment one of antennae more than one and one-half times as long as four.....10

10. Segment one of antennae about twice as long as segment four; last tarsal segment (three) of intermediate legs equal to segment two; posterior femora in female with smaller spines much reduced; length 3.8–4.4 mm.
Rh. arctoa new species

Segment one of antennae about one and two-thirds but not twice as long as segment four; last tarsal segment (three) of intermediate legs slightly longer than segment two; posterior femora in female with smaller spines diminishing in length toward tibial end; length 3.5–3.7 mm.
Rh. obesa Uhler

What follow are more in the nature of diagnoses than of complete descriptions, but it is deemed that they reveal sufficient of the distinctive characters of each species to fix it definitely. Few descriptions to date of *Rhagoveliae* have given more than two or three structural characters; and these so lacking in precision that it is not the easiest thing in the world to fix a species when such characters as are given are group characters. Of course, at the time such descriptions were drawn up, in view of the slender number described before the appearance of the Heteroptera

part of Biologia Centrali-Americana, these few structural characters in connection with the meticulous color descriptions were quite enough to distinguish between the very few known species. Champion, by his description at one time of nine new species, at once more than doubled the seven known species of New World *Rhagoveliae*, to which total four other species have since been added. With the three new forms herein noted, our present total from the Western Hemisphere reaches twenty-three, which, adding the four known from the Eastern Hemisphere, gives us twenty-seven species in the genus.

All these new forms, particularly the five here discussed and *distincta* Champion, have thrown open the question of critical differential characters in the genus, a few of which are employed here in a preliminary way.

Rhagovelia rivale new species

Antennal formula: I : II : III : IV :: 15 : 10 : 10 : 10.

Intermediate legs: femur : tibia : tarsal seg. II : tarsal seg. III :: (male) 33 : 24 : 12 : 12 : (female) 33 : 26 : 15 : 13.

Males, apterous. Pronotum sharply curved posteriorly, broader than long; posterior femora thicker than tibiae, with the usual long, slender curved spine, followed distally by four or five smaller, slender curved spines growing shorter apically, femoral spine nearer base than apex; posterior tibiae with a stout, straight apical spine; formula posterior leg:—tibia : tars. seg. II : seg. III :: 22 : 3 : 5; anterior trochanters with a stout black spine on the outer aspect.

Females, apterous: Pronotum posteriorly more gradually curved than in male, broader than long; posterior femora not thicker than intermediate, with a sharp curved spine one third of its length from joint of tibia; connexivum reflexed, but not meeting above abdomen, its terminal spines small.

Both sexes dull sericeous black.

Apterous, long, males, 3.3–3.6 mm.; females, 4.3–4.6 mm.
Apterous, wide, males, 1.32 mm.; females, 1.65 mm.

The winged form has two characteristics in addition to the stouter thorax with prominent humeri and an obsolete longitudinal median carina. The wings are the usual dull brown pilose; the venation is well-marked; and they extend beyond the apex of the abdomen. In addition, in the male the thorax is angularly produced posteriorly with the pointed end turned up; and in the female it is produced into a long knob, of equal diameter throughout, also turned up.

Long, males, 4 mm.; females, 4.45 mm.

Wide, males, 1.43 mm.; females, 1.65 mm. at humeri.

Type, apterous female, Dykeman's Bridge, Kansas, July, 1922; *morphotype*, winged female, same data; *paratypes*, six apterous males, three apterous females, one winged male and one winged female, same data.

Type in collection University of Kansas; paratypes in same and collection of J. R. de la Torre Bueno.

Rhagovelia oriander Parshley

Antennal formula: I : II : III : IV :: 15 : 9 : 10 : 8, or 15 : 8 : 10 : 8.

Intermediate legs: femur : tibia : tars. seg. II : tars. seg. III :: 33 : 21 : 12 : 14, or 33 : 22 : 12 : 15.

Males, apterous: Pronotum bluntly acuminate posteriorly, partly covering the ring-like meso- and metanotum; posterior femora much incrassate, with a long curved comparatively slender spine followed by a double series of six smaller spines decreasing in length toward the apex; posterior tibiae coarsely denticulate; tarsal segment II : tarsal segment III :: 3 : 6; anterior trochanters with a blunt black spine on the outer aspect. Last abdominal segment nearly cylindrical, twice as long as the preceding.

Females, apterous: Pronotum terminated posteriorly in a long blunt knob. Posterior femora slightly enlarged, not much thicker than tibiae; femoral spine placed one-third length of femur from tibia, slender, curved, followed by a shorter spine; tarsi as in male. Anterior trochanter without a spine. Connexivum much reflexed over abdomen, meeting over last abdominal segment, two long lateral bristles on each side of the polished upper surface of the genital segment; last angle of connexivum produced into a stout black spine; no tuft of hairs on edge of first segment.

Long, male, 3.6 mm.; female, 3.7 mm.

Wide, male, 1.1 mm.; female, 1.4 mm.

The winged form is unknown.

In addition to these characters, Parshley gives "head with median line and two lateral areas smooth and depressed; first antennal segment strongly curved; proportions of antennal segments—18 : 10 : 10 : 9; pronotum minutely and irregularly punctate; legs long and rather slender; middle femora sometimes compressed at middle; hind tibia with a small tooth at apex; second and third segments of middle tarsi equal in length."

As to the impressed smooth median line, this seems to be a family character; the curvature of the first antennal segment is also a group character. The proportions of the antennal segments also vary from mine, but that is probably because my measurement of the first segment is on a chord, while his probably follows the curve. On the other hand we have the discrepancy in the tarsal segments, for which I can offer no explanation.

Rhagovelia flavicincta new species

Antennal formula: male, I : II : III : IV :: 13 : 9 : 9 : 9, or 13 : 8 : 8 : 8, or 13 : 8 : 9 : 8; female, 15 : 9 : 10 : 10.

Intermediate legs: femur : tibia : tars. seg. II : tars. seg. III :: (male) 30 : 22 : 12 : 13; (female) 33 : 25 : 12 : 15.

Males, apterous: Femoral spine long, curved, black-tipped, three-fifths its length from apex, followed apically by five or six smaller ones of nearly equal length; hind femora incrassate, nearly twice as thick as intermediate; posterior femora : tibiae : tarsal segment II : tarsal segment III :: 25 : 22 : 3 : 5; posterior tibiae with a straight spur at apex; anterior trochanters with a stout black spine.

Females, apterous: Pronotum truncate; posterior femora slightly enlarged; femoral spine slender, curved, followed by about five minute spines which grow smaller toward the apex; spine placed two-fifths of its length from tibial joint; posterior tarsus II, post. tars. III :: 3 : 5 ±. No spine on anterior trochanters. Connexivum not quite meeting over last abdominal segment; last connexival angle produced into a stout black spine; first segment of connexivum fringed with closely appressed long black hairs, which have the appearance of a long black spine; connexivum broadly margined with flavous, glabrous.

Long, males, 3.2–3.5 mm.; females, 3.5–3.85 mm.

Wide, males, 1.1 mm.; females, 1.2–1.25 mm.

Aside from the structural characters and smaller size, the species is readily distinguished by its broadly flavous connexivum and the flavous bases of antennae and legs, and the coxae and trochanters and the coxal plates as well.

Type, female, Raleigh, North Carolina, June 5, 1906, C. S. Brimley collector; *paratypes;* one male, same data; male, same place, October 20, 1920, Brimley collector; three males, same place, October 13, 1915, R. W. Leiby collector; two males, Swannanoa, North Carolina, October 5, 1915, Leiby; two females, Raleigh, June 5, 1906, Brimley; one female, same place, October 13, 1915, Leiby; four females, October 5, 1920, Leiby.

Type in collection of C. S. Brimley; paratypes in same and in collections of J. R. de la Torre Bueno, H. M. Parshley and the American Entomological Society.

It may here be noted that the spine on the anterior trochanters of the male, and the tuft of long hairs on the first connexival segment in the female are secondary sexual characters.

Rhagovelia arctoa new species

Antennal formula: male, I : II : III : IV :: 16 : 9 : 10 : 9; female, 17 : 10 : 9 : 8.

Intermediate legs: femur : tibia : tars. seg. II : tars. seg. III :: 35 : 25 : 15 : 15.

Males, apterous: Femoral spine not very slender, straighter, followed by six blunt spines, stouter in comparison, more prominent; femoral spine three-fifths length of femur from apex; posterior tibia denticulate; posterior tars. seg. II : seg. III :: 3 : 6; anterior trochanters with a stout black spine on the outer aspect; abdominal segments two to five subequal, six twice as long as the preceding one.

Females, apterous: Pronotum posteriorly sinuately truncate, feebly carinate longitudinally. Posterior femora with a sharp curved spine followed by smaller ones, as in male; not much stouter than intermediate femora. Anterior trochanters without a spine; connexivum reflexed, meeting above last abdominal segment and terminating acutely in two long divaricating spines; genital segment trapezoidal, polished above; edge of first segment of connexivum with long hairs appressed to form a seeming spine.

Long, males, 3.8–4.4 mm.; females, 4.2–4.4 mm.

Wide, males, 1.1 mm.; females, 1.4 mm.

Type, apterous male, Little Devil Track Creek, Cook County, Minnesota, August 11, 1922, H. B. Hungerford collector; *paratypes*, sixteen apterous males and six females, same data; four females, two males, August 12, 1922, same locality, W. E. Hoffman collector; six males, six females, Bengal, Minnesota, August 18, 1922, Hoffman collector.

Type, in collection of University of Kansas; paratypes in the same, and collections of W. E. Hoffman, H. M. Parshley, J. R. de la Torre Bueno and the American Entomological Society.

Rhagovelia obesa Uhler

Antennal formula, male and female, I : II : III : IV :: 15 : 9 : 10 : 9; sometimes 13 : 8 : 9 : 9.

Intermediate legs: male, femur : tibia : tars. seg. II : tars. seg. III :: 35 : 25 : 14 : 15; female, 32 : 23 : 12 : 15.

Males, apterous: Pronotum rounded posteriorly, meso- and metanotum showing curving about pronotum as narrow rings; posterior femora much thicker than tibiae, a long curved slender spine about middle, followed by about six smaller ones, diminishing in size toward tibial joint, the nearest one almost like a small tubercle; posterior tibiae coarsely bluntly tuberculate; posterior tars. seg. II : seg. III :: 3 : 6; anterior trochanters with a stout black spine on the exterior face.

Females, apterous: Pronotum sinuate-truncate posteriorly, otherwise as in male; posterior femora about the same thickness as the tibiae, with a long curved spine placed two-fifths of the length of the femur from the tibial joint, followed apically by five smaller spines diminishing in length toward the tibial joint; anterior trochanters without a spine; connexivum reflexed and meeting above the terminal abdominal segment, the last angles produced into two long black divaricating spines; genital segment narrower than long; connexivum of first segment with long appressed hairs, appearing like a long slender curving spine.

Long, males, 3.5–3.6 mm.; females, 3.65–3.7 mm.

Wide, males, 1.1 mm.; females, 1.25+ mm.

The rare winged form may easily be recognized by the fixed characters of the legs and antennae; and by the bifid pronotal spine in the male.

The characters used in these descriptions are all plain under the binocular microscope, objective 55 mm. and eyepiece × 10. All comparative measurements are to the same scale and at the same magnification. It must be noted that the scale is arbitrary and numerical only, and is not intended to give the measure of parts, but only their proportions. Where measurements are given they are so indicated.

References

Bueno, J. R. de la Torre. 1916. The Veliidae of the Atlantic States. Bulletin Brooklyn Entomological Society, xi, pp. 52–61.

Ibid. 1923. The Hemiptera of Connecticut. Bulletin 34, Conn. State Geological and Natural History Survey, pp. 417–418.

Champion, G. C. 1892. Biologia Centrali-Americana; Rhynchota Heteroptera ii, pp. 131–140.

Parshley, H. M. 1922. Report on a Collection of Hemiptera from South Dakota. Technical Bulletin no. 2, South Dakota State College, p. 19.

Uhler, P. R. 1871. Notices of some Heteroptera in the Collection of Dr. T. W. Harris. Proc. Boston Society Natural History, xiv, pp. 94–112. (*Rh. obesa*, p. 107.)

Ibid. 1878. Notices of the Heteroptera in the Collection of the late T. W. Harris, M. D. Proc. Boston Society of Natural History, xix, pp. 365–446. (*Rh. obesa*, p. 434.)

A REVISION OF THE GENUS TAENIOPODA (ORTHOPTERA, ACRIDIDAE, CYRTACANTHACRINAE)

BY MORGAN HEBARD

In order to locate the correct name for the single species of the genus *Taeniopoda* Stål which occurs in the United States, we have been obliged to study the Mexican species fully and this has led to the present revision. The series before us includes all of the eleven species which we believe should be recognized. Of these the validity of *picticornis* is the least certain, while the condition which we consider the optimum development of *auricornis* may eventually prove worthy of nominal recognition.

Three distinct groups exist, the first including *eques*, *picticornis* and *stâli*, the last *obscura*, while the second comprehends all the others, with the possible exception of *bicristata*, which agrees in pronotal form but shows the distinctive coloration of *obscura*.

It is evident that the genus breaks into few species, the majority having an extensive distribution and each subject to great variation in size and color. The fact that convergence is often shown between species having a very distinct facies in their typical condition, combined with the many very unsatisfactory early descriptions, has caused numerous errors in the past and has made our efforts to clear up the considerable synonymy unusually difficult.

The distribution of the species is as follows. One is found from Trans-Pecos Texas and southern Arizona and the Mexican table-land southwestward to Jalisco. Two are known from eastern coastal Mexico. One occurs in Morelos and Guerrero. One is confined to Yucatan. One has been described from Oaxaca. Two are found in the wet tropical eastern portions of Central America from Honduras to Panama. Two inhabit the drier portions of Central America from Guatemala (and probably southern Mexico) southward to Costa Rica. The exact locality for the remaining species is not known, though it is supposed to have been secured in the Mexican state of Puebla. Thus *Taeniopoda* is seen to be an arid tropical North American genus,

of the species of which but two have invaded the wet tropical regions of Central America, one of these extending the distribution of the genus as far south as Darien, Panama.

Our most serious difficulty has been that little material from extreme southern Mexico is available for study. Collections from that region should aid greatly in clearing up the exact status of *picticornis* and *citricornis*.

It is also possible that additional series may show *reticulata* to be a race of *centurio* and *varipennis* a race of *gutturosa*. In both cases the former name is based on the entity developed to the southward in a more tropical environment.

The genotype of *Taeniopoda* is *T. picticornis* (Walker), selected by Rehn in 1904. The Group Taeniopodae also includes *Romalea* Serville, a genus of the southeastern United States, represented by a single species.

The single types of four of the eleven definitely recognized species are in the Philadelphia collections. Three hundred and thirty-six specimens have been examined in the preparation of the present study, in addition to three hundred and fourteen specimens of *eques* from the United States, which will shortly be recorded in a separate paper.

The following key includes the characters which appear to have the most value in distinguishing the species. So much general plasticity is shown, however, that a key alone must never be relied upon in determing material of *Taeniopoda*.

A. Pronotal crest low, scarcely more than a very decided carina. Pale joints of antennae each finely annulate with black distad.

B. Veins and veinlets of tegmina narrowly to broadly defined in yellowish green. Sides of pronotal crest never suddenly darker than lateral portions of dorsum.

C. Pale portions of antennae capucine orange.

D. Areas between tegminal veins and veinlets usually completely filled with dark brown. (Typically with head and pronotum black, marked with orange yellow and tegmina broadly tipped with black.) Trans-Pecos Texas, southern New Mexico and southern Arizona, south to Tepic and Jalisco, Mexico..... *eques* (Burmeister)

DD. Areas between tegminal veins and veinlets with small flecks of dark brown. (Head and pronotum yellowish-olivaceous with yellow markings weakly indicated and tegmina lacking black tips.) Oaxaca, Mexico. *picticornis* (Walker)

CC. Pale portion of antennae light scarlet red. (Otherwise as in *picticornis* except that the green of the tegmina is richer.) Morelos, Guerrero and Puebla, Mexico.
stali Bruner

BB. Veins and veinlets of tegmina very narrowly defined in brownish yellow. Sides of pronotal crest narrowly and suddenly black. (Antennae missing. Ground color of head and pronotum auburn.) Tamaulipas, Mexico . . *tamaulipensis* Rehn

AA. Pronotal crest high. Pale joints of antennae without annuli.

B. Form not as robust. Lateral carinae of pronotal disk not as prominent. Coloration not mottled like a dead leaf. Tegmina with all veins and veinlets conspicuously pale.

C. Coloration predominantly pale, only a portion of the intervals between the broadly pale veins and veinlets dark. Size small to medium large.

D. Form robust. Metazonal portion of pronotal disk slightly shorter to slightly longer than broad. Antennae yellow, the two proximal joints of that color or partly black. Hidalgo, Vera Cruz and extreme southern Tamaulipas, Mexico . . . . . *auricornis* (Walker)

DD. Form more slender. Metazonal portion of pronotal disk conspicuously longer than broad. Antennae scarlet red to orange (this latter due partly to fading ?), the two proximal joints black.

E. Pronotal metazona moderately produced caudad. Pronotal crest moderately high, with a narrow but conspicuous lateral black marking. Tegmina largely chalcedony yellow (a light olivaceous yellow). Size averaging small. Guatemala . . . . . *gutturosa* (Bolivar)

EE. Pronotal metazona strongly produced caudad. Pronotal crest very high, immaculate or inconspicuously darkened laterad. Tegmina largely antimony yellow. Size averaging medium large. Western Nicaragua and Costa Rica . . . . . *varipennis* Rehn

CC. Coloration predominantly dark, more than half the intervals between the less conspicuously pale veins and veinlets dark. Size very large.

D. Pronotum rather strongly produced caudad. Pale portions of antennae orange buff. Pale portions of tegmina warm buff, their apices usually margined with blackish brown. Honduras, Guatemala and Nicaragua.
centurio (Drury)

DD. Pronotum very strongly produced caudad. Pale portions of antennae peach red (more yellowish if discolored). Pale portions of tegmina vinaceous pink, their apices without a dark margin. Panama and eastern Costa Rica..... *reticulata* (Fabricius)

BB. Form very robust. Lateral carinae of pronotal disk prominent. Coloration dark brown, mottled like a dead leaf. Tegmina with veins and veinlets narrowly light brown, inconspicuously paler.

C. Pronotal crest high, higher in the metazonal portion. Lateral portions of pronotal disk deplanate only in cephalic portion of metazona; lateral carinae heavy, rugulose but regular; caudal production decided. (Puebla ?,) Mexico. *bicristata* Bruner

CC. Pronotal crest high, lower in the metazonal portion. Lateral portions of pronotal disk deplanate in all of metazona; lateral carinae heavy, lamellate laterad, irregularly rugose; caudal production not decided. Yucatan, Mexico. *obscura* Bruner

We have omitted *T. citricornis* Bruner from the above key, due to decided uncertainty as to its validity.

Taeniopoda eques (Burmeister)

1838. *Rh[omalea] eques* Burmeister, Handb. Ent., II, abth. II, pt. I, p. 620. [♂, ♀; Zimapan, [Hidalgo,] Mexico.]

1859. *Rh[omalea] eques* Saussure, Rev. et Mag. de Zool., (2), XI, p. 392. [♂, ♀; "Mexico calida".]

1901. *T[aeniopoda] burmeisteri* Bolivar, Bull. Soc. Española Hist. Nat., I, p. 266. [♀, Mexico.[1]]

1901. *T[aeniopoda] picticornis* Bolivar, (not *Rhomalea picticornis* Walker, 1870), ibid., p. 267. [♂; Ventanas, Durango, Mexico, at 2000 feet.]

1903. *Taeniopoda picticornis* Caudell (not *Rhomalea picticornis* Walker, 1870), Proc. U. S. Nat. Mus., XXVI, p. 795. [Base of foothills of Guadalupe Mountains [Culberson County, Texas].]

1904. *Taeniopoda burmeisteri* Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 530. [♂; City of Mexico [Distrito Federal]; Guadalajara and Tuxpan, Jalisco; Monterey, Nuevo Leon, all in Mexico.]

1907. *Taeniopoda picticornis* Bruner (not *Rhomalea picticornis* Walker, 1870), Biol. Cent.-Amer. Orth., II, p. 234, pl. II, fig. 17. [♂, ♀; Southern Arizona; Lerdo, Durango and Mesquitic, Jalisco, Mexico.]

[1]Bolivar was of the opinion that Burmeister, in 1838, under the name *Rhomalea centurio*, had described a male of the species we recognize here as *eques*. We believe that Burmeister only attempted to give a resumé of the characters of the material figured by Drury and described as *centurio* in 1773, and at the same time of the apparently distinct insect figured and described also as *centurio* by Stoll in 1813 (see discussion under *centurio* and *tamaulipensis*).

1907. *Taeniopoda stâli* Bruner, ibid., p. 234. (In part.) [♂, ♀; Territory of Tepic, Mexico.]

This insect, *T. picticornis* (Walker) and *T. stâli* Bruner are easily separated from the other known species of the genus by the lower pronotal crest and marking of the pale antennal joints, which are narrowly black at their apices. Typically these species are easily recognized, but *eques* shows such color variation, often so divergent toward the others, that the separation of material is in some cases extremely difficult. Such color variation would make the earlier descriptions most difficult to place, were the geographic limits of each not at present known.

We find that *eques* has a wide distribution in Mexico, being found from Tuxpan, Jalisco, as far north as Escuinapa, Sinaloa and central-eastern Sonora on the west coast,[2] and east of the Sierra Madre over all of the higher country from Mexico City northward, extending brief distances into the United States in Texas, New Mexico and Arizona.

Over most of this territory the insect has the head and pronotum black marked with yellow,[3] a color phase which apparently is not developed in either *picticornis* or *stâli*. In the southwestern portions of its distribution and in the Sonoran series, however, the ground color of head and pronotum is yellowish-olivaceous with yellow markings very weakly indicated.[4] Such is the case to varying degrees in specimens of the Guadalajara series before us, in all from Tepic and Sonora, but not in the Sinaloa series.

In *eques* the tegmina are also heavily tipped with black in material from the United States, this heavier in the male sex. This marking is individually somewhat variable in extent, often forming a broad, black, distal suffused area. It shows reduction in more southern material and, in females alone, is occasionally entirely absent in the material from Tepic and Guadalajara.

As a result, females of *eques* of general yellow green coloration and unsuffused tegminal extremities can not be separated from individuals of *picticornis*, except by the slightly less decided green of the tegminal veins and veinlets and by the larger areas

[2] The genus is not represented in large collections before us from coastal Sinaloa as far south as Mazatlan, the Gulf of California and Baja California.

[3] Typical *eques*, redescribed by Bolivar as *burmeisteri*, in 1901.

[4] This color phase was incorrectly referred to *picticornis* by Bolivar, in 1901.

of dark brown between, though the typical condition of *eques* is exceedingly different in appearance.

Material from additional localities of *picticornis*, which we recognize as known only from the state of Oaxaca, Mexico, may therefore prove that that condition represents merely a geographic race of *eques*, though no direct evidence of such is as yet available.

The same aberrant color phase of *eques* agrees fully with *ståli*, except in the following features, which do not appear to be variable. The latter species has the pale portions of the antennae red instead of yellow and the paler portions of the tegmina distinctly more green. When we consider the decided color variation found in *eques*, these features do not appear to carry great weight, but in the nineteen specimens of *ståli* before us they are absolutely constant.

A single melanistic male of *eques* is before us, from Tuxpan, Jalisco, Mexico. This individual, except for the normally colored wings, is black, with a fine medio-longitudinal line of buff on the occiput, caudal margin of the pronotum and dorsal margins of the caudal femora proximad. Melanism is similarly found to occur very rarely in other species of the genus.

It is unfortunate that Bolivar, in his revision of *Taeniopoda*, in 1901, failed to work out correctly the Burmeisterian discussion of *eques* and *centurio*. The fact that a valueless color feature[5] was used in the first division of Bolivar's key has led to further confusion. In *eques* alone, which frequently has a broad black suffusion at the tegminal apices, occasional individuals show also a narrow greenish margin of the immediate apices of the tegmina and wings. This is purely a feature of individual variation.

Great size variation as well as variation in development of the organs of flight occurs, this having little or no geographic significance. The extremes in a series of ninety-seven individuals from the Espinosa Rancho, Altar Valley, Pima County, Arizona, and the largest female from an adjacent locality are given here,

[5] Extremity of tegmina and radial field of wing blackish, but terminated by a pale band; contrasted with tegmina terminated by a narrow black apical margin, the radial field of the wings black at the extremity, without a white apical border.

the discussion of the balance of the series of three hundred and two individuals from the United States before us, being reserved for the paper in preparation on the species as found in that country.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Guadalajara, Jalisco.....	42	12.2	7	40	10.8	22
Guadalajara, Jalisco.....	42.7	12.2	7.2	40.5	10.8	23.8
Ocotlan, Jalisco.....	38.5	11.2	6.6	32.2	7.8	21.7
Toluca, Toluca.....	42	12	7.9	36.7	10.1	23.7
Copete Mine, Sonora....	49	15.1	8.1	43.7	11.7	25.2
Copete Mine, Sonora....	58	17.2	9.2	49.1	12.2	29.4
Monterey, Nuevo Leon..	33.3	11.3	7	28.2	7.3	20
Espinosa Rancho, Arizona	38.8	12.7	6.8	25	6.2	20.7
Espinosa Rancho, Arizona	50	15	8.8	44.5	11.5	26.2
♀						
Guadalajara, Jalisco.....	53	14	8	34	10.3	23.8
Ocotlan, Jalisco.....	43.2	12.3	7.8	24.2	6.9	21
Tepic, Tepic.....	47.2	13.8	8.2	32.7	9.6	23.3
Tepic, Tepic.....	63.8	16.8	9.3	36	11.4	26
Copete Mine, Sonora....	58	19.1	11.7	51.2	12.4	28.8
Copete Mine, Sonora....	65.7	19.2	11	38.3	9.9	27.7
Espinosa Rancho, Arizona	40.9	13.1	7.4	23	6.2	19.4
Espinosa Rancho, Arizona	59.9	17.7	10.9	36.2	10	27
Sycamore Canyon, Arizona.....	70.5	22	11.2	42.9	11.2	29

In addition to a series of thirty-four previously recorded Mexican specimens, in the Philadelphia collections, we have now before us the following Mexican material.

Guadalajara, Jalisco, September, 1903, (W. L. Tower), 2 ♂, 2 ♀; 1901, (M. Deguet), 2 ♂, 1 ♀, [All Amer. Mus. Nat. Hist.].

La Barranca de los Obletos, Jalisco, September 13, 1903, (from J. L. Hancock; limestone cliffs), 1 ♂, [Hebard Cln.].

Ocotlan, Jalisco, September 18, 1903, (from J. L. Hancock; acacia flats at Lake Chapala), 1 ♀, [Hebard Cln.]; September, 1903, (W. L. Tower), 8 ♂, 30 ♀, [Amer. Mus. Nat. Hist.].

Acacia flats north of railroad, east of Rio Grande de Santiago, Jalisco, 5000 feet, September 18, 1903, (W. L. Tower), 1 ♀, [Amer. Mus. Nat. Hist.].

Toluca, Mexico, August, 1903, (W. L. Tower), 1 ♂, [Hebard Cln.].

Escuinapa, Sinaloa, (J. H. Batty), 4 ♂, 1 ♀, [Amer. Mus. Nat. Hist. and Hebard Cln.].

Copete Mine, thirty miles east of Carbo, Sonora, (F. C. Nicholas), 11 ♂, 16 ♀, [Amer. Mus. Nat. Hist. and Hebard Cln.].

Taeniopoda picticornis (Walker)

1870. *Rhomalea picticornis* Walker, Cat. Dermapt. Saltat. British Mus., III, p. 538. (In part.) [♂, ♀; Oaxaca, Mexico.[6]]

1873. *T[aeniopoda] picticornis* Stål, Recensio Orth., I, p. 51. [♂, ♀; Mexico.]

We have discussed this insect under *T. eques* (Burmeister), suggesting the possibility that it may represent a geographic race of that species.

Since the original description, material of *eques* and *T. ståli* Bruner has been repeatedly recorded as *picticornis*. The latter name is now limited to the insect which occurs in the state of Oaxaca, Mexico.

It agrees fully with *ståli* except in the coloration of antennae and tegmina, as noted in the key. The tegmina are lime green or chrysolite green, suffused proximad with blackish brown, but with dark brown areas between the veins and veinlets very small, this feature most decided in the distal portions.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Oaxaca, Oaxaca.....	35	11	6.7	34.2	9.2	—
Oaxaca, Oaxaca.....	38.5	11.2	6.9	37.5	9.8	20.5
♀						
Oaxaca, Oaxaca.....	46.8	13.9	8	38.8	10.8	24.9

The specimens before us bear the following data:

Oaxaca, Oaxaca, August 16, 1903, (W. L. Tower), 6 ♂, 1 ♀, [Amer. Mus. Nat. Hist. and Hebard Cln.].

[6] Through the very kind co-operation of B. Uvarov at the British Museum, we have been able to verify our belief that Walker's material from Oaxaca represented the insect diagnosed in the present key as *picticornis*, but that the specimen from Puebla is distinct, referable to Bruner's *ståli*. This assignment of names is established by our here selecting as single type of *Rhomalea picticornis* Walker, the male from Oaxaca, from M. Sallé, in the British Museum.

Pacaya, Oaxaca, August 16, 1903, (from J. L. Hancock), 1 ♂, [Hebard Cln.].

Taeniopoda ståli Bruner

1870. *Rhomalea picticornis* Walker, Cat. Dermapt. Saltat. British Mus., III, p. 538. (In part.[7]) [♂; Puebla, Mexico.]

1900. *Taeniopoda picticornis* Rehn (not *Rhomalea picticornis* Walker, 1870), Trans. Amer. Ent. Soc., XXVII, p. 97. [♂, ♀; Cuernavaca, Morelos, Mexico.]

1902. *Taeniopoda picticornis* Rehn (not *Rhomalea picticornis* Walker, 1870), Trans. Amer. Ent. Soc. XXIX, p. 12. [♂, ♀; Cuernavaca and Yautepec, Morelos, Mexico.]

1907. *Taeniopoda ståli* Bruner, Biol. Cent.-Amer., Orth., II, p. 234, pl. II, fig. 18. (In part.[8]) [♂, ♀; Amula, Guerrero, Mexico.[9]]

The tegminal veins and veinlets are, in this insect, deep chrysolite green, the intervals between with small dark brown areas. In some these dark areas are reduced distad to small flecks in the middle of each section and such material is indistinguishable from Oaxacan material of *T. picticornis* (Walker) except by the vivid red of the antennae. The occiput also has a small suffusion of red meso-caudad.

Though the present insect may eventually prove to be nothing more than a striking chromatomorph of *T. eques* (Burmeister), the present series is so constant in the differences of coloration that we believe it should be recognized as a distinct species.

The extremes of the present series measure as follows (in millimeters).

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Amula, Guerrero, *paratype*	38.3	11.8	6.7	32.8	8	20.9
Amula, Guerrero, *paratype*	42.5	12.4	6.9	38.4	11.2	22.7
Cuernavaca, Morelos	39	10.8	7.4	40.9	10.9	22.3

[7] Having examined the original series of *Rhomalea picticornis* Walker, the male from Puebla, from Mrs. Rouquette, has been found by B. Uvarov to have the paler portions of the antennae red. Through this kind assistance we are here able to place this specimen.

[8] The series from Tepic, included by Bruner, is referable to *T. eques* (Burmeister). This material is in the author's collection.

[9] The figured male, taken at an elevation of 6000 feet by H. H. Smith and belonging to the British Museum, is here selected as single type of *Taeniopoda ståli* Bruner.

♀	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Cuernavaca, Morelos....	49.3	13	8.7	36.8	10.5	25
Yautepec, Morelos.....	62	15.3	9.5	38.8	10.9	27.1

Nineteen previously recorded specimens are in the Philadelphia collections, including several paratypes belonging to the author.

Taeniopoda tamaulipensis Rehn

1813. [*Gryllus Locusta*] *centurio* Stoll (not of Drury, 1773), Natuur. Afbeeld. Beschryv. Spooken etc., Trek-springhaanen, p. 15, pl. VIb, fig. 19, Register p. 12. ["Niew Georgie" (=Georgia, in error).]

1904. *Taeniopoda tamaulipensis* Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 531. [♀; Alta Mira, Tamaulipas, Mexico.]

Stoll's figure agrees much more closely with the type of *tamaulipensis* than with material of any other species known to us. That figure is, however, so unsatisfactory that definite assignment can not be made, without examination of the specimen from which it was drawn.

The tegmina of the type have the veins and veinlets, at present, buffy-brown, with a very feeble tinge of olivaceous.[10] The antennae of the type are missing, but in a large immature female, bearing the same data, they are blackish, except for a few joints beyond the first two, which are brownish-yellow, finely annulate with blackish.

The insect appears to be annectant between the preceding and following species. Of the latter nearest relationship is shown to *T. auricornis* (Walker). The height of the pronotal crest is greater than in the former, but much less than in the latter group. The antennal (apparently) and tegminal colorations agree with the former group also, while the pronotal coloration shows close agreement with that of *T. centurio* (Drury) and *auricornis*.

The two specimens discussed above belong to the Academy of Natural Sciences of Philadelphia. No additional material has been reported.

Taeniopoda auricornis (Walker)

1859. *Rh*[*omalea*] *centurio* Saussure (not *Gryllus centurio* Drury, 1773), Rev. et Mag. de Zool., (2), XI, p. 392. [♂, ♀; Mexico calida.[11]]

[10] Described in 1904 as "olive-green." Some fading may have subsequently occurred, but this seems unlikely.

[11] There is a female from this series in the Academy of Natural Sciences of Philadelphia, donated by H. de Saussure and labelled "centurio."

1870. *Rhomalea auricornis* Walker, Cat. Dermapt. Saltat. British Mus., III, p. 538. [♂, ♀; [States of] Oajaca and Vera Cruz [Mexico].]

1901. *T[aeniopoda] pulchella* Bolivar, Bull. Soc. Española Hist. Nat., I, p. 269. [♂, Mexico.]

1902. *Taeniopoda centurio* Rehn (not *Gryllus centurio* Drury, 1773), Trans. Amer. Ent. Soc., XXIX, p. 12. [♂, ♀; Quaqualtipan, Hidalgo; Jalapa, Texolo and Orizaba, Vera Cruz, all in Mexico.]

1904. *Taeniopoda auricornis* Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 532. [♂, ♀; Alta Mira, Tamaulipas, Mexico.[12]]

1905. *T[aeniopoda] auricornis* Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 414, fig. 13. [♀; Alta Mira, Tamaulipas, Mexico.]

1905. *T[aeniopoda] pulchella* Rehn, ibid., p. 414, fig. 14. [♀; Jalapa, Vera Cruz, Mexico.]

1907. *Taeniopoda auricornis* Bruner, Biol. Cent.-Amer., Orth., II, p. 237, pl. II, figs. 22 and 22a. [[♂, ♀; Orizaba and] Medellin, Vera Cruz, Mexico.]

1907. *Taeniopoda pulchella* Bruner, ibid., p. 237. [[♂, ♀]; San Rafael, Vera Cruz, Mexico.]

Bolivar apparently overlooked Walker's description of *auricornis* at the time he described *pulchella*. Since that time these names have caused much confusion, as both Rehn and Bruner attempted to retain them, the one for a large lowland phase of the species (*auricornis* of Rehn, *pulchella* of Bruner), the other for the better known smaller typical condition which appears to inhabit the higher country just west of the lowlands of Vera Cruz. Material from Medellin, Vera Cruz, shows different degrees of intermediacy between these phases, while it is evident that the names *auricornis* and *pulchella* were both based on the smaller phase. Careful analysis convinces us that the larger, unnamed phase, represents a local adaptation rather than a geographic race and is, therefore, not considered worthy of nominal recognition.

In order to avoid future confusion, however, we note the differences shown by these phases.

Lowland phase. Size larger (length of pronotum, ♂, 17 to 18.3; ♀, 21.1 to 23 mm.). Pronotal crest very high; metazona decidedly produced caudad, the free lateral margins moderately to markedly concave. Extreme southern Tamaulipas and lowlands of Vera Cruz.

[12] This material represents the large lowland phase of the species, the "*centurio*" with which comparison was made actually representing the smaller highland phase of the same species, recognized the following year as *pulchella* by Rehn.

Highland phase. Size smaller (length of pronotum, ♂, 11.1 to 15; ♀, 14.1 to 18 mm.). Pronotal crest moderately high; metazona moderately produced caudad, the free lateral margins straight to weakly concave. Hidalgo and Vera Cruz, probably above lowlands.[13]

Were it not for the fact that various intergradations between these phases are shown by the four specimens before us from Medellin, Vera Cruz, situated near the coast in the lowlands, we confess that it would have seemed almost imperative to give the four other lowland specimens before at least geographic racial status.

The insect is clearly quite as variable as *T. eques* (Burmeister), the extremes developed being almost more strikingly different in appearance.

This is a more robust and generally paler species than any of the preceding. Care must be taken to avoid confusion with the Central American *T. varipennis* Rehn. These species may be separated by the features given in the key.

The ground color of head and pronotum is yellow or brownish-yellow, the latter usually immaculate but sometimes with lateral portions of the crest darkened. A very few individuals show a narrow darkened area on the sides of the pronotal crest, but the lateral carinae of the metazona are pale in all. The tegmina usually show considerable reduction, their general coloration is amber yellow, sometimes dull or with a faint olivaceous tinge, with only about half the intervals between the veins and veinlets dark brown, and their apices immaculate or occasionally with a very narrow margin of dark brown.

The general size variation as well as that of the organs of flight is shown by the following measurements in millimeters.

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Alta Mira, Tamaulipas..	51.1	17	9.1	30.9	9.3	26.6
"Vera Cruz," *type*[14].....	37	15	7	22	8	21
Medellin, Vera Cruz.....	40.9	12.9	6.3	23.6	6.9	20.9
Medellin, Vera Cruz.....	44	14.5	7.1	27.8	8.7	24

[13] Walker's originally included material from "Oaxaca" apparently represents this phase, but we have no subsequent data to show that the species occurs in that state.

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
San Rafael, Vera Cruz...	45.9	18.3	8.7	30.8	9.2	27.4
Jalapa, Vera Cruz.....	32.8	13	6.8	29.4	9.1	20.9
Orizaba, Vera Cruz.....	30.2	11.1	5.9	21.6	6.2	19.5
Orizaba, Vera Cruz.....	35.7	11.3	6.6	27.1	8.2	21.2
♀						
Alta Mira, Tamaulipas...	57.2	21.1	11.3	30.8	12	27.8
Medellin, Vera Cruz.....	45	14.9	8.1	22	8	21.2
Medellin, Vera Cruz.....	52.2	19.3	10.1	28.8	10	25.1
San Rafael, Vera Cruz...	54	23	11.1	35	13	29.8
Jalapa, Vera Cruz.....	43.3	15	8.8	25.5	9	22.3
Jalapa, Vera Cruz.....	51	17.8	10.5	35.7	10.9	24.2
Orizaba, Vera Cruz.....	44.8	14.1	8.8	23.7	8.2	20.9
"Oaxaca," *paratype*.....	36[15]	17.5	9.5	24	9	22
"Oaxaca," *paratype*.....	49[16]	18	10	25	9	22.5

In addition to a series of thirty-three specimens in the Philadelphia collections, there are now before us the following previously unrecorded individuals from Mexico.

Xico, Vera Cruz, February 16, 1897, (L. Bruner), 1 ♂, [Hebard Cln.].

Orizaba, Vera Cruz, December 1887, (Smith and Godman), 6 ♂, 1 ♀; February, 1887, (L. Bruner), 22 ♂, 6 ♀, [all Hebard Cln.].

Tezonapa, Vera Cruz, November 15, 1905, (W. L. Tower), 2 ♂, 1 ♀, [Amer. Mus. Nat. Hist.].

Taeniopoda centurio (Drury)

1773. *Gryll[us] Loc[usta] centurio* Drury, Illustr. Nat. His., Exot. Ins., II, p. 78, pl. XLI, fig. 3, index 2d page. [[♀], Bay of Honduras.]

1855. *M[onachidium] superbum* Stål, Öefv. Vet. Akad. Förh., XII, p. 352. [♀, Honduras.]

1901. *T[aeniopoda] centurio* Bolivar, Bol. Soc. Española Hist. Nat., I, p. 268. [♂, Mexico.[17]]

[14] We here select this specimen, from M. Sallé, belonging to the British Museum, as type of *Rhomalea auricornis* Walker. The measurements of this individual, as well as of two female paratypes, also in the British Museum, have been most kindly sent us by B. Uvarov.

[15] Abdomen distended.

[16] Abdomen very much contracted.

[17] Though Bolivar has apparently placed *centurio* correctly, the locality given is somewhat puzzling. We have no Mexican material of the species, the nearest approach to which is shown by the optimum type of *T. auricornis* (Walker), found in the lowlands of Vera Cruz.

1902. *Taeniopoda superba* Rehn, Trans. Amer. Ent. Soc., XXIX, p. 12. [♂, ♀; Honduras; Gualan, Guatemala; Rio Escondido, fifty miles from Blewfields, Nicaragua.]

1907. *Taeniopoda superba* Bruner, Biol. Cent.-Amer., Orth., II, p. 235. [♂, ♀; Rio Sarstoon, British Honduras; Panzos, Vera Paz, Guatemala.]

It is somewhat surprising that Mexican species of the genus have so often been mistaken for this insect, though Drury's figure is by no means perfect, and we are informed by B. Uvarov that Drury's types no longer exist. Stål's description of *superbum* leaves no doubt as to the synonymy of that name.

After his description of *centurio* Bolivar has described a variety *reticularis*, also from "Mexico." Though that name was given specific rank by Kirby in 1910, we believe it eventually will be placed in the present synonymy. Examination of that type may, however, show it to be a synonym of *auricornis* instead.

This species and the closely related *T. reticulata* (Fabricius) represent the largest and handsomest forms of the genus. They may be separated from each other and the other species of *Taeniopoda* by the characters given in the key.

The next nearest relationship shown by *centurio* is to *T. auricornis* (Walker). Though typically very distinct, surprising convergence is found when dark specimens of the lowland optimum of that species are compared with small individuals of *centurio*. This convergence is, however, not sufficient to confuse, if the species are known to the student. It also appears very probable that the two are well separated geographically.

In the material of *centurio* before us the head and pronotum are dark yellowish brown, the sides of the pronotal crest usually, but not always, shining black, the lateral carinae of the metazona rarely slightly darkened. The ground color of the tegmina is warm buff, the areas of mummy brown between the veins and veinlets evenly distributed and occupying about the same space as the pale areas, also between the veins and veinlets. This gives the tegmina a very different appearance, from those species in which it is the veins and veinlets themselves which form the most conspicuous portion of the pale tegminal markings. The tegmina are usually broadly suffused with blackish brown at their apices, but this is sometimes much reduced, and in one female before us is very narrow and inconspicuous. Though

the antennae are pale to near their dark apices, the first two joints are of the same dark color as the head.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Panzos, Guatemala.....	46.5	18.2	8.9	42	12.8	27.3
Panzos, Guatemala.....	46	18.2	9.1	43	13	28.3
Nicaragua.....	48.2	18	10.2	39	12.1	25.9
Nicaragua.....	50.5	18.3	10	45.2	13	26.3
♀						
Panzos, Guatemala.....	54	21.3	11.2	41.3	12.2	28.8
Rio Sarstoon, British Honduras.....	54	20.3	10.9	40	12	26.8
Rio Sarstoon, British Honduras.....	56.3	24	12.1	51.2	16	32.2
Nicaragua.....	61.8	20.2	11.7	41.7	12.3	25
Nicaragua.....	61	22	13.2	38.7	12.9	27.8

In addition to nine previously recorded specimens in the Hebard Collection, the following are before us.

Coban, Vera Paz, Guatemala, (G. C. Champion), 1 ♀, [Hebard Cln.].

San Miguel, Vera Paz, Guatemala, 7000 feet, August,1916, 1 ♂, 2 ♀, [Hebard Cln.].

La Ceiba, Honduras, October 15, 1916, (F. J. Dyer), 1 ♂, [Amer. Mus. Nat. Hist.].

Nicaragua, 5 ♂, 3 ♀, [Hebard Cln.].

Taeniopoda reticulata (Fabricius)

1781. *G[ryllus] reticulatus* Fabricius, Spec. Ins., I, p. 362. [[♀], Bengal (in error).]

1800. *Gryllus reticulatus* Fabricius, in Donovan, Ins. of India, pl. 12, fig. 1. (Fabricius' type figured.)

1905. *Taeniopoda centurio* Rehn (not *Gryllus centurio* Drury, 1773), Proc. Acad. Nat. Sci. Phila., 1905, p. 410. [♂, ♀; San Carlos, Costa Rica.]

1907. *Taeniopoda maxima* Bruner, Biol. Cent.-Amer., Orth., II, p. 235. [♂, ♀; Limón, Costa Rica.]

1924. *Taeniopoda reticulata* Hebard, Trans. Amer. Ent. Soc., L, p. 103. [♀; Darien, Panama.]

We are entirely indebted to B. Uvarov for the correct assignment of this name to the insect described by Bruner as *maxima*.

Fabricius' type is in the British Museum and we are informed that "the specimen figured by Donovan is the actual type, now in the Banks Collection, which has been undoubtedly preserved for some time in a liquid. The crest and the lateral carinae of the pronotum are black and the tegmina are not suffused apically. The colors of the figure in the Westwood Edition of Donovan (1842) are much exaggerated." Reference to our key will show at once that *reticulata* is not a synonym of *T. centurio*, (Drury), as has been generally supposed, but represents the closely allied, more southern species, described as *maxima*.[18]

In the series at hand the head and pronotum range from indian red (becoming in places pompeian red) to blackish diamine brown. The pronotal crest is usually shining black, this narrow in the metazonal portion, but in a few specimens such marking is lacking. The lateral carinae of the metazona are strikingly black in a few specimens, but are usually only slightly darkened. The tegmina in some have the veins and veinlets narrowly vinaceous pink with few of the intervals of that color, in others the pale areas occupy fully as large a portion of the surface as in the palest examples of *centurio*. In a very few specimens a mere trace of dark apical marginal marking is shown. The dark portions of the antennae are as in *centurio*, the pale portions being red instead of orange, but apparently subject to some fading in drying.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
San Carlos, Costa Rica..	48.5	20.2	8.8	44	13.2	28
Siquirres, Costa Rica....	43.3	17.5	7.7	34.7	9.8	25.1
Siquirres, Costa Rica....	52	18.2	8.6	45	12.5	28.8
Limón, Costa Rica[19].....	46	18.8	8.1	44.7	13.2	25.7
♀						
Siquirres, Costa Rica....	54.2	19.3	9.5	38	11	26
Siquirres, Costa Rica....	61.8	24.4	10.8	41.7	12.8	29.2
Limón, Costa Rica[20].....	69.5	25.5	10.8	45.2	13.2	31
Darien, Panama.....	61	—	10	40.3	11.5	31.7

[18] Bruner's type and allotype of *T. maxima* are in the author's collection.
[19] Type of *T. maxima* Bruner.
[20] Allotype of *T. maxima* Bruner.

In addition to four previously recorded specimens in the Philadelphia collections, the following are before us.

Caché, Costa Rica, (H. Rogers), 2 juv., [Hebard Cln.].

Carrillo, Costa Rica, fall of 1903, (C. F. Underwood), 1 ♂, [Hebard Cln.].

La Emilia, near Guapiles, Costa Rica, November 19, 1909, (P. P. Calvert; edge of forest and potrero), 1 ♀, [Acad. Nat. Sci. Phila.].

Guapiles, Costa Rica, June 5, 1909, (P. P. Calvert), 1 ♀, [Acad. Nat. Sci. Phila.].

Chara, Costa Rica, November 23, 1915, (A. Alfaro), 1 ♂, [Acad. Nat. Sci. Phila.].

Siquirres, Costa Rica, July 3, 1903, (M. A. Carriker, Jr.), 9 ♂, 7 ♀, [Hebard Cln.].

Atalanta Farm, Ley River, Estrella Valley, Costa Rica, May 19, 1924, (J. C. Bradley; abundant on vine-covered bushes in banana field), 2 ♂, 3 ♀, [Cornell Univ.].

Taeniopoda gutturosa Bolivar

1901. *T[aeniopoda] gutturosa* Bolivar, Bol. Soc. Española Hist. Nat., I, p. 268. [♂, ♀; Escuintla, Guatemala.]

1907. *Taeniopoda gutturosa* Bruner, Biol. Cent.-Amer., Orth., II, p. 235. [♂, ♀; San Geronimo, Guatemala.]

1907. *Taeniopoda aurantia* Bruner, ibid., p. 235. [♀, Guatemala.]

A paratype of *aurantia* in the author's collection shows that name to be a synonym of *gutturosa*. Compared with the three females and two males before us, recorded by Bruner as *gutturosa*, that name is seen to be based on specimens which are somewhat more robust, with general coloration of head and pronotum pink instead of yellowish olivaceous and medio-longitudinal line and cheeks of the former scarlet red instead of salmon orange. No other differences are to be found and these are certainly attributable to individual variation.

The narrowly shining black sides of the pronotal crest afford a very conspicuous color feature in the present insect, as the pronotum elsewhere is much paler. The brief lateral carinae of the pronotal prozona caudad, but not of the metazona, are blackish in all but one individual, this continued less conspicuously on the metazona in all but two of the six examples before us. The tegmina are chalcedony yellow (a light olivaceous yellow), with scattered flecks of dark brown. They agree closely, therefore,

with those of *T. varipennis* Rehn, except that they are greenish instead of clear yellow. The antennae are as in *varipennis*, the two black proximal joints preventing confusion with those of *T. auricornis* (Walker).

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
San Geronimo, Guatemala	31.2	10.4	4.9	22.8	6	17.3
San Geronimo, Guatemala	31	10.7	5.3	29.8	8	19.2
♀						
San Geronimo, Guatemala	40	13.6	7.2	23.3	7	19.8
San Geronimo, Guatemala	44.8	14.7	7.9	32.3	9.7	21.3
Guatemala[21]	47	17.3	8.9	26.7	8.1	23

No material has been seen additional to that recorded by Bruner.

Taeniopoda citricornis Bruner

1907. *Taeniopoda citricornis* Bruner, Biol. Cent.-Amer., Orth., II, p. 234. [♂; Venta de Peregrino, Guerrero, Mexico.]

The type, in the British Museum, has been examined by B. Uvarov, who states that, though he is not familiar with the characters which should be considered of specific diagnostic value for the genus *Taeniopoda*, this specimen appears to represent a distinct species from *T. gutturosa* Bolivar, as recognized by us.

He has most kindly sent us the following data on this type. "Larger and more robust than a male of *gutturosa* from San Geronimo, Guatemala. Antennae with the two basal joints pale olivaceous, the rest chrome yellow, without black rings (the apical joints are missing). Frontal costa above ocellus with lateral margins distinctly and evenly convex (in *gutturosa* practically straight except at ocellus). Fastigio-facial angle more broadly rounded. Apical angle of fastigium nearly ninety degrees (distinctly acute in *gutturosa*). Eyes projecting distinctly less laterad. Pronotum distinctly less compressed laterad, the metazona less produced caudad with angle more obtuse. Tegmina extending well beyond caudal femora, with green network of veinlets but with nearly all cells, or at least their centers,

[21] A paratype of the synonymous *aurantia*.

black. Caudal femora with only narrow semilunar blackish spots distad. Caudal tibiae brownish olivaceous (distinctly blackish inwardly in *gutturosa*)."

Even with the valuable information given above added to the original description, we do not feel able to determine the validity or position of *citricornis*, without actual examination of the type or similar material from southern Mexico.

Taeniopoda varipennis Rehn

1905. *Taeniopoda varipennis* Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 410, figs. 10 and 11. [♂, Central America;[22] ♀, San José, Costa Rica.]
1907. *Taeniopoda varipennis* Bruner, Biol. Cent.-Amer., Orth., II, p. 237. [♂, ♀; Chontales, Nicaragua; San José, Costa Rica.]
1907. *Taeniopoda flavida* Bruner, Biol. Cent.-Amer., Orth., II, pl. II, figs. 20 and 20a. (Name on plate, corrected in text.)

This handsome insect is closely related to *T. gutturosa* Bolivar. It can be separated by the features given in the key. These may not prove to be very decided when it has become possible to study *gutturosa* from larger series. In all of the species of *Taeniopoda*, known from considerable series, very decided individual size variation occurs. There is quite a little individual variation in the cristation and degree of production of the caudal portion of the pronotum in *varipennis*, though in this latter feature the majority of the specimens show a decidedly greater development than do the few specimens of *gutturosa*.

The pronotal crest and lateral carinae are typically immaculate in *varipennis*, but in six specimens traces of black are found, in none of these nearly as decided or in as sharp contrast as in any of the examples of *gutturosa*. The paler portions of the tegmina apparently never show an olivaceous tinge in *varipennis*, which appears to be a characteristic of *gutturosa*. The usual coloration of head and pronotum is yellow, suffused individually to different degrees with brown and often with a medio-longitudinal streak on the occiput. A pinkish phase (like that developed in *gutturosa* and given the synonymic name *aurantia* by Bruner) also occurs, this decided in part of the Nicaraguan series, but particularly so in the material from Ujurras de Terraba, Costa Rica, these latter individuals being also of an unusually intensive coloration.

[22] This is the originally figured male and is here selected as single type of the species, Hebard Collection Type no. 300.

The dark markings scattered over the tegmina are sometimes few in number, in many just as in the figured type and occupying decidedly less than half the tegminal area, but in some larger and more numerous, thus occupying decidedly more than half the tegminal area.

The male before us from Chontales, Nicaragua, is melanistic. In color it is solidly brownish black, except the normally pale portions of the antennae and the anal fields of the tegmina, which are dark brown. The wings in this specimen are brilliantly colored, in no way different from the normal condition.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Camoapa, Nicaragua	41.2	16	7.2	35.8	10.8	23
San José, Costa Rica	36	13.6	6.2	29.8	8.8	20.2
Pozo Azul de Pirrís, Costa Rica	45	16.7	7.8	40.8	11.7	24.6
Gulf of Nicoya, Costa Rica	38.5	14.8	7.2	34	9.5	21.9
Gulf of Nicoya, Costa Rica	39	15.2	7.3	37.8	10.2	22.1
♀						
Camoapa, Nicaragua	54	17.8	9.2	35	10.9	25
Nicaragua	56	21.1	10.3	41.5	13.2	28.3
San José, Costa Rica	46.3	17.2	8.5	39	10.8	22.7
San José, Costa Rica	56.8	23.8	10.8	41.8	11.9	29.3
Gulf of Nicoya, Costa Rica	50.8	19.9	9.8	33.9	10.4	25.3
Gulf of Nicoya, Costa Rica	55.6	19.6	9.9	40.8	12.7	25.2

In addition to eight previously recorded specimens, including the type and a male paratype, the following series is before us.

Camoapa, Nicaragua, 3 ♂, 6 ♀, [Hebard Cln.].

Chontales, Nicaragua, (E. M. Janson), 1 ♂, melanistic, [Hebard Cln.].

Nicaragua, 1 ♀, [Hebard Cln.].

Ciruelas, Costa Rica, August 15, 1915, (A. Alfaro), 4 ♂, 2 ♀, [Acad. Nat. Sci. Phila.].

Ujurras de Terraba, Costa Rica, September 10, 1907, (M. A. Carriker, Jr.), 3 ♂, [Hebard Cln.].

Pozo Azul de Pirrís, Costa Rica, (C. F. Underwood), 1 ♂, [Hebard Cln.].

Gulf of Nicoya, Costa Rica, 5 ♂, 13 ♀, 2 juv., [Acad. Nat. Sci. Phila. and Hebard Cln.].

Taeniopoda bicristata Bruner

1907. *Taeniopoda bicristata* Bruner, Biol. Cent.-Amer., Orth., II, p. 236. [♀; "Mat." (Matamoros, Puebla?), Mexico.]

This insect agrees very closely with *T. obscura* Bruner in being dark brown, irregularly marked with light brown, which gives an entirely different color effect from that of any of the other species of the genus. The pronotal crest and lateral carinae are solidly black, however, while the structural characters given in the key further separate it from that insect.

Additional material of this remarkable species is needed not only to ascertain how much plasticity occurs and to determine the differences found in the male sex, but also to fix definitely the region in which it occurs and its limits of distribution.

The type female[23] measures as follows: length of body, 56.3; length of pronotum, 23.8; caudal width of pronotal disk, 12.3; length of tegmen, 33.3; width of tegmen, 12.2 mm.[24]

Taeniopoda obscura Bruner

1907. *Taeniopoda obscura* Bruner, Biol. Cent.-Amer., Orth., II, p. 235, pl. II, figs. 21 and 21a. [♂, ♀; Temax, Yucatan,[25] Mexico.]

The striking coloration developed in this species and *T. bicristata* Bruner readily separates these from the other known members of the genus. Other features of difference are noted in the accompanying key.

Bruner was probably correct in supposing that the insect lives in dead leaves, but it must be in an arid scrub environment rather than in "tropical forests," which do not occur in northern Yucatan.

[23] Hebard Collection Type no. 299.

[24] The caudal femora are missing.

[25] The type and four paratypes in the author's collection are from this locality, as well as another paratype labelled "Yucatan." The specimen originally recorded as from Medellin, Vera Cruz, Mexico, was incorrectly labelled.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Width of tegmen	Length of caudal femur
Temax, Yucatan, *type*....	41.7	15.9	10.1	38.7	10	23.7
Temax, Yucatan, *paratype*	46.5	17.9	10	41.3	11.2	24.8
Merida, Yucatan.....	41	15	9	32.1	9.8	21.4
Merida, Yucatan.....	41.2	15.9	9.4	38.7	10.8	22.8
Yucatan.....	52.2	17.5	10.2	41.3	12.8	24.9
♀						
Temax, Yucatan, *allotype*.	59.8	22.4	12.9	41.4	12.8	26.3
Temax, Yucatan, *paratype*	60.2	22.8	13.8	39.2	11.6	28.8
Temax, Yucatan, *paratype*	56	21.3	12.8	38.8	11.6	27.1
Merida, Yucatan.....	52.8	19	11.4	36.2	11	25
Merida, Yucatan.....	61.5	23.7	14	37.7	12	27.9

The following previously unrecorded material is before us. Valladolid, Yucatan, Mexico, (A. Gaumer), 1 ♂, [Hebard Cln.] Merida, Yucatan, Mexico, (A. Gaumer), 3 ♂, 2 ♀, [Hebard Cln.].

THE DIPTEROUS GENUS SYNTORMON IN NORTH AMERICA (DOLICHOPODIDAE)

BY M. C. VAN DUZEE

Buffalo, New York

The genera *Syntormon* and *Synarthrus* were established by Dr. H. Loew, in 1857, for species having the second joint of the antennae overlapping the third on inner surface with a thumb-like projection; the two genera being separated by the former having hair on the upper edge of the first antennal joint, and the latter having the first antennal joint bare. Both are now united under the name *Syntormon*. Dr. T. Becker in his work on the American Dolichopodidae, 1921, also unites with this genus our species of *Parasyntormon*, a genus established by Dr. Wheeler in 1899. He seems to me to have overlooked the great difference in the face of the females of the two genera; in the females of all our species of *Syntormon*, and I think all European species also, the lower portion of the face is very wide, concave, and with the lower edge remarkably thin and projecting; while in the species of *Parasyntormon* the lower part of the face of the females is quite narrow for a female, convex, and the lower edge not at all projecting, but somewhat retracted.

Dr. Becker has united with the above the species of the genus *Eutarsus* Loew, 1857. I scarcely see why he does this, as the antennae of both male and female are very different from those of *Syntormon*, being almost like those of some of the species of *Chrysotus* or *Diaphorus*, the third joint being somewhat rounded or slightly triangular, the arista subapical or dorsal, never apical, the second joint cuts into the third, more so on the inner surface, therefore overlapping the third joint more or less on inner side. Having never seen any species of this genus I am not in a position to give a very decided opinion as to their position.

Syntormon quadratum Aldrich should be placed in the genus *Parasyntormon*, as the face of the female is as in that genus, not at all projecting below.

All the males of the species of *Syntormon* included in this paper have the posterior basitarsi modified, except *simplicitarse* new species, which has all tarsi plain.

The species treated of in this paper can be separated into three groups, according to the form of the posterior basitarsi of the male. The first group would contain but one species, *simplicitarse*, in which the posterior basitarsi are plain; the second group has a pair of hook-like bristles near the base below, this contains two species, *strataegum* Wheeler and *tricoloripes* Curran; the third group contains the species having a long sinuous bristle near the middle of the lower surface of hind basitarsi, there are eight species in this group, two of which are separated from the rest by having the middle tarsi ornamented, these are *palmare* Loew and *ornatipes* new species.

I am greatly indebted to Dr. J. M. Aldrich for the privilege of examining the material in the National Museum and for the loan of the species which were undescribed, and to Mr. Curran, of the Canadian National Museum, for the loan of type material of *tricoloripes* Curran, and other specimens which he took at Hull, Quebec.

Table of Males of the North American Species

1. Middle tarsi with some of the joints compressed.....2
   All tarsi plain, except the usual modification of the posterior basitarsus.....3
2. Third and fourth joints of middle tarsi compressed and fringed, fifth joint orbicular, first two joints pale yellow or whitish, last three black; tips of hind tibiae much enlarged, deep black; middle ones wholly yellow.
   palmare Loew
   Last three joints of both middle and hind tarsi much compressed, forming an oval tip to the tarsi; tips of both middle and hind tibiae enlarged and deep black.
   ornatipes new species
3. All femora yellow, the tips of posterior pair may be black..4
   Femora black or green, at least two pair partly so.....7
4. Posterior basitarsus plain; hypopygium large, partly disengaged; antennae partly yellow.
   simplicitarse new species
   Hind basitarsus with a long sinuous bristle below; hypopygium imbedded, almost concealed; antennae wholly black.5

5. Posterior femora wholly yellow, without black at tip. *cinereiventre* Loew
   Posterior femora conspicuously black at tip.....6
6. All coxae blackish, anterior pair only a little yellow at tip. *affine* Wheeler
   Fore coxae almost wholly yellow....*femoratum* new species
7. Middle femora wholly or largely yellow, at least with apical half yellow.....8
   All femora black or green, at least largely so.....9
8. Hind femora with two broad green bands, one at base and one near the tip.....*strataegum* Wheeler
   Hind femora black or green with a narrow yellow tip. *dissimilipes* new species
9. Posterior basitarsus with a pair of hook-like bristles near their base.....*tricoloripes* Curran
   Posterior basitarsus with one long sinuous bristle near the middle below.....10
10. Posterior tibiae gradually but considerably enlarged at tip. *clavatum* new species
    Posterior tibiae scarcely at all enlarged at tip. *bisinuatum* new species

Syntormon palmare Loew

Loew, Mon. N. Am. Diptera, part II, p. 135, (1864).

This interesting species is fully described by Dr. Loew. The joints of fore tarsi are as 35–11–10–7–6; those of middle tarsi (fig. 8) are as 41–9–11–10–7; the first and second joints of hind tarsi (fig. 6) are as 23–17. The antennae (fig. 7) are very much like those of *ornatipes* new species, in the form of the first joint, which is very wide.

Described from Alaska, J. M. Aldrich reports it from Washington. I have seen specimens from Seattle, Washington and from Pacific Grove, California, the latter taken May 9. Both these are in the collection of J. M. Aldrich.

Syntormon ornatipes new species

Male: Length, 3 mm. Face white, moderately wide, narrowed in the middle. Palpi brown. Front green, rather dull. Antennae (fig. 11) black; first joint wide, about as wide as long; second overlapping third on inner side; third long tapering, arista scarcely half as long as third joint. Orbital cilia pale below.

Thorax green, dorsum with brown pollen; pleura with white pollen, abdomen green, its hairs mostly black, still there are a few white hairs on the sides; first segment with long pale hairs on the sides at base and long yellow hairs on the venter. Hypopygium mostly concealed.

All coxae black; anterior pair with yellow hairs. Fore femora black with base and tip yellow; middle femora wholly yellow with a row of black bristles on lower posterior edge of basal half, these are scarcely as long as the thickness of the femora; hind femora yellow with the tip more or less brown above. All tibiae yellow, middle and hind ones sharply black at their tips, which are considerably enlarged, tips of middle ones conspicuously so when viewed from above, because the tibiae above the tip are distinctly compressed. Fore tarsi black from the tip of the first joint, fifth joint slightly widened and with a few bristly hairs at tip; joints of fore tarsi as 35–14–9–6–6. Middle tarsi (fig. 12) with the first two joints thin when viewed from above, yellow; last three joints black, flattened and fringed on the sides with hairs; joints of middle tarsi as 50–30–8–6–6. Hind tarsi (fig. 9) black from the middle of the first joint, which has a long, erect but slightly sinuous bristle just before the middle of lower surface, and a small erect, straight bristle just beyond the middle; last three joints flattened and fringed on the sides with small hairs; joints of hind tarsi as 27–40–10–7–8. All pulvilli small, white. Calypters pale yellow with a brown tip and white cilia. Halteres yellow.

Wings grayish, rather dark; third and fourth veins nearly parallel beyond the cross-vein, still the third bent backward so as to approach fourth a little at tip; last section of fifth vein twenty-nine, cross-vein fourteen, fiftieths of a millimeter.

Female: Face wide and projecting below, as is usual in the genus, mostly brown, still sometimes greenish. Antennae (fig. 10) small; first and second joints slender, third about as long as wide, the second overlapping the third a little on inner side. Front, thorax and abdomen about as in the male. All coxae black; fore femora black with yellow base and tip. Middle and hind femora wholly yellow. All tibiae yellow, middle and hind ones narrowly black at tip, but scarcely enlarged. All tarsi plain, black from the tip of the first joint. Joints of fore tarsi as 33–12–14–10–9; of middle ones as 41–19–12–6–9; and those of hind pair as 27–33–15–9–10. Wings with the last section of fifth vein twenty-nine, of cross-vein seventeen, fiftieths of a millimeter.

Described from four males and four females taken by J. M. Aldrich, at Marshall Pass, Colorado, July 28, 1908, at 10,856 feet elevation.

Holotype and allotype in the United States National Museum.

Syntormon cinereiventre Loew

Loew, Neue Beitr., VIII, p. 48; Mon. N. Am. Diptera, part II, p. 137.
Wheeler, Psyche, v, p. 362, (June, 1890).

This rather small species has the third antennal joint of the male about twice as long as wide, the arista much shorter than third joint; front shining violet; fore coxae and all femora and tibiae wholly yellow; all tarsi yellow at base; the middle femora have on the second fourth of the lower surface a row of six stout black bristles, the first one short, the others each longer than the preceding one, the last, which is near the middle of the femora, is nearly as long as the width of the femora. Hind basitarsus (fig. 1) with a long sinuous bristle near the middle

Fig. 1—*Syntormon cinereiventre* Loew, posterior basitarsus. Fig. 2—*S. femoratum* new species, posterior basitarsus of male. Fig. 3—*S. bisinuatum* new species, posterior basitarsus of male. Fig. 4—*S. affine* Wheeler, posterior basitarsus of male. Fig. 5—*S. dissimilipes* new species, male posterior basitarsus. Fig. 6—*S. palmare* Loew, first two joints of hind tarsus. Fig. 7—Antenna of male of same (arista broken). Fig. 8—Middle tarsus of same. Fig. 9—*S. ornatipes* new species, posterior tarsus of male. Fig. 10—Antenna of female of same. Fig. 11—Antenna of male of same. Fig. 12—Middle tarsus of same. Fig. 13—*S. strataegum* Wheeler, posterior basitarsus of male. Fig. 14—*S. tricoloripes* Curran, posterior basitarsus of male. Fig. 15—*S. simplicitarse* new species, hypopygium of male. Fig. 16—Antenna of male of same.

of lower surface. Joints of fore tarsi as 20–10–8–5–6; of middle ones as 22–10–8–6–6; those of hind tarsi as 16–13–10–6–7. Last section of fifth vein twenty-one, of cross-vein fifteen, fiftieths of a millimeter.

This was described from "The Middle States;" Osten Sacken reports it from Texas, Wheeler from Wisconsin. I have seen specimens from New York, Maryland, Indiana and eastern Canada.

Syntormon affine Wheeler

Wheeler, Proc. Calif. Acad. of Sciences, II, p. 38, (1899).

The posterior basitarsus is about the same as in *cinereiventre* Loew (fig. 4). The joints of the fore tarsi are as 29–12–9–7–6; of middle ones as 30–14–12–7–8; and of posterior pair as 20–18–13–10–9; the posterior femora are broadly black at tip, the fore coxae blackish, their tips yellowish. Last section of fifth vein twenty-two, cross-vein eighteen, fiftieths of a millimeter.

Described from Monterey, California. I took it at Alpine, and on the edge of the Colorado Desert, San Diego County, California, in April, and at Wells, Nevada, June 6.

Syntormon femoratum new species

Male: Length, 2 mm. Face narrow, eyes touching in the middle (perhaps because the head is shrunken), whitish. Palpi black; proboscis brown. Front shining violet. Antennae black, third joint as long as the face, wide at base, tapering to a point; arista apical, scarcely as long as the third joint; second antennal joint overlapping the third on inner surface for more than half their length. Upper orbital cilia black, cilia on the lower half white.

Thorax green, dorsum shining with only a little pollen along the front; pleura dulled with white pollen; scutellum violet in the center, with two large marginal bristles. Abdomen shining metallic green with the hairs on its dorsum black; first segment with long white hairs on the venter. Hypopygium concealed.

Fore coxae yellow, a little brownish at base on outer surface, their anterior surface with very minute white hair; middle and hind coxae green with yellow tips. All femora and tibiae yellow; posterior femora conspicuously black at tip, except on lower edge; hind tibiae a little brownish at tip. Middle femora with a row of black hairs on lower edge, a few of these on basal half are very black, thick and closely set, they are quite long at the

middle of the femora, decreasing rapidly in length towards the base of the femora, but not quite reaching the base. Fore tarsi black from the tip of the first joint; middle and hind tarsi black or brown almost to their base, yet the first joint more or less yellowish. Hind basitarsus (fig. 2) has on its lower surface a long, bisinuate bristle at the middle and three shorter, straight ones on apical half. Joints of fore tarsi as 24–9–7–5–8; of middle ones as 25–10–8–6–8; joints of hind pair as 17–12–8–7–8. Calypters yellow with a narrow brown edge and yellow cilia. Halteres yellow.

Wings a little grayish; first vein reaching a little more than half the distance to the cross-vein; third and fourth veins nearly parallel beyond the cross-vein; last section of fifth vein twenty-one, of cross-vein eleven, fiftieths of a millimeter.

Described from one male, taken by Dr. J. M. Aldrich, at Lafayette, Indiana, June 13, 1918.

Type in the United States National Museum.

Syntormon clavatum new species

Male: Length, 2.5–2.7 mm. Face quite wide above, narrow below, silvery white. Palpi black. Front blue-green. Antennae black; second joint overlapping third on inner surface for about half their length; third joint but little longer than wide; arista apical, about as long as the antenna. Lateral and inferior orbital cilia pale, a few of the upper cilia black.

Thorax blue-green; scutellum with one pair of large bristles and a few pale hairs. Abdomen green; first segment with a few long white hairs on each side. Hypopygium mostly concealed.

All femora and coxae dark green or blackish; tips of fore and middle femora and their tibiae yellow. Fore coxae with white hairs, which are not conspicuous except near the tips. Middle femora with a row of delicate black bristles below; middle tibiae slightly brownish at extreme tip. Hind tibiae yellow at base for one-fourth (or a little more) of their length; about apical three-fourths black; they are gradually but considerably enlarged towards their tips. All tarsi black or dark brown; first joint of hind tarsi slightly arched, it has a row of stout hairs and two bristles below, the larger bristle is inserted just beyond the middle, is bent at its middle and is nearly three-fourths as long as the joint, the other bristle is inserted near apical fourth and is as long as the diameter of the joint. Joints of fore tarsi are as 22–10–8–6–7; of middle ones as 28–13–10–7–7; joints of hind tarsi as 20–20–14–8–8. Calypters yellow with extreme tip brown, their cilia whitish. Halteres yellow.

Wings grayish; third and fourth veins nearly parallel beyond the cross-vein; last section of fifth vein not quite twice as long as the cross-vein.

Described from fourteen males, which I took at Wells, Nevada, June 6.

Holotype in the author's collection.

Syntormon bisinuatum new species

Male: Length, 2.5 mm. Face only showing a little below (probably because the head is shrunken), silvery white; in one specimen the face is quite wide above, silvery white with the green ground color showing through just below the antennae. Palpi black. Front dark violet. Antennae black; third joint a little longer than wide, rounded at base, pointed at tip; second joint overlapping third nearly to its middle; arista apical, about as long as the antenna. Orbital cilia pale and short below, stiff and black above.

Thorax green with violet or blue reflections, its bristles long; scutellum with two long marginal bristles, besides these there are several delicate, but quite long, yellowish hairs on the margin. Abdomen green, hind margins of the segments slightly bronzed; hairs of the abdomen black, but appearing slightly yellowish in certain lights, sides near the base with white hairs. Hypopygium concealed.

Coxae greenish with white hairs, fore and middle pairs a little yellow at tip. All femora blue-green; middle pair with a few stiff, black bristles below, which are most conspicuous near basal third, where they end abruptly, yet they are continued by a few hairs that are not just in the same line. Fore and middle tibiae yellow, slightly darkened at extreme tip. Posterior tibiae black, more or less yellowish at base, with a row of stiff black hairs below, which become longer apically. Fore and middle tarsi black with the first joint more or less yellowish at base. Hind tarsi wholly black; first joint (fig. 3) a little bent, hollowed below; lower surface with several short bristles and one long one, the latter inserted beyond the middle, has a double curve and if straightened out would be only a little shorter than the basitarsus. Joints of fore tarsi as 26–11–8–7–7; of middle ones as 25–12–9–8–8. Calypters small, yellowish with a brown tip and white cilia. Halteres yellow.

Wings grayish; third and fourth veins nearly parallel, fourth ending in the apex of the wing; last section of fifth vein thirty-one, of cross-vein fifteen, fiftieths of a millimeter.

Described from three males, taken at Hood River, Oregon, June 3 and 4, 1917, by F. R. Cole; and one male taken at Pacific Grove, California, May 8, 1906, by J. M. Aldrich.

Holotype, male, taken at Hood River, Oregon, in the author's collection. The California paratype is in the United States National Museum.

Syntormon dissimilipes new species

Male: Length, 2.7 mm. Face narrow, silvery white. Palpi small, black. Front violet. Antennae black; third joint twice as long as wide, pointed at tip; second joint lapping over third for one-third its length; arista about equal to third joint in length, apical. Lower orbital cilia pale, the upper cilia black.

Thorax blue-green, a little dulled with brown pollen; posterior edge of pleura with hairs; scutellum with a few pale hairs and one pair of large marginal bristles. Abdomen green; first segment with a few long, bristly, white hairs on each side. Hypopygium green, small, with stiff short hairs.

Coxae blue-green with white hairs. Anterior and posterior femora green, the former broadly, the latter narrowly yellow at tip. Middle femora wholly yellow, with a row of close-set, small, black bristles below on basal half, which are short near the base, becoming longer towards the middle, where they end abruptly, beyond these there is a row of more widely separated, stiff, black hairs. Hind femora with several black bristles on lower anterior edge near the tip, and one preapical bristle. All tibiae yellow; posterior pair blackened on apical half, and a very little enlarged at tip. Fore and middle tarsi black from the tip of the first joint; hind tarsi wholly black, first joint (fig. 5) slightly arched and with a long bisinuate bristle inserted beyond the middle of lower surface, this bristle is nearly four-fifths as long as the joint; there is also one or two rather long, straight bristles below near the tip. Joints of fore tarsi are as 28–11–10–8–8; of middle tarsi as 26–11–10–8–7; joints of hind tarsi as 20–15–10–7–6. Calypters yellow with a brown tip and yellow cilia. Halteres yellow.

Wings grayish; third and fourth veins nearly parallel beyond the cross-vein; last section of fifth vein twenty-four, of cross-vein fifteen, fiftieths of a millimeter.

Female: Several females which were taken with the males described above agree with them in having the front violet, and in the wing characters; have the third antennal joint very short, rather rounded at tip, arista inserted above the center of the end of third joint; face wide, greenish, concave, projecting below; fore femora green, yellow at base and tip; middle and

hind femora and all tibiae yellow; posterior tibiae brown at extreme tip; fore and middle tarsi brown; hind tarsi black, plain.

Described from twenty-one males and eleven females. I took seven males and two females at Wells, Nevada, June 6, 1915. Dr. Aldrich took all the others; five males and one female at Juliaetta, Idaho; two males and one female at Moscow, Idaho, June 19, 1900; one male at Grangeville, Idaho, June 27, 1907; five males and six females at Lawyer's Canyon, Idaho, June 16, 1909; and one pair at Emigrant Canyon, Wasatch Mountains, Utah, July 8, 1911, at 7,000 ft. elevation.

Holotype and allotype, taken at Wells, Nevada, are in the author's collection; the Idaho paratypes are in the United States National Museum.

Syntormon strataegum Wheeler

Wheeler, Proc. Calif. Acad. of Sci., II, p. 39, (1899).

This large species has the third antennal joint a little longer than wide, pointed at tip; arista as long as the antennae; front black with coppery or bronze reflections. Face silvery white. Hypopygium small, almost concealed; there appear to be minute whitish lamellae, fringed with white hairs. All coxae black, anterior pair with white hairs. Fore femora green with yellow tips; middle femora yellow, green at base, sometimes the green reaches to their middle; hind femora yellow with two green bands, one at base and one near the apex. Fore and middle basitarsi yellow with a black tip; hind tarsi wholly deep black, their first joint (fig. 13) considerably arched, their lower surface with a pair of hook-like bristles near the base. Joints of fore tarsi are as 40–17–12–8–8; those of middle pair as 40–21–14–7–7; joints of hind tarsi as 23–29–20–11–11. Last section of fifth vein thirty, of cross-vein twenty-three, fiftieths of a millimeter; wings dark grayish, sometimes with a small obscure cloud at the middle of last section of fourth vein and another at its tip; the cross-vein slightly clouded.

Described from Wyoming and California. I have seen specimens from California taken by J. M. Aldrich and J. C. Bradley.

Syntormon tricoloripes Curran

Curran, Canadian Entomologist, LV, p. 209, (1923).

Male: Length, 5 mm. Face narrow, silvery white. Palpi black, covered with white pollen. Front greenish.[1] Antennae black; third joint a little longer than wide, pointed at tip; second joint overlapping third on inner side to near its middle; arista

[1] Curran says, "metallic purple," but the paratypes I have seen have the front green.

apical, slightly longer than the antenna. Upper orbital cilia black, stout, they reach to the middle of the eye, they are continued by a row of long white hairs, back of which are more long white hairs on the lower part of the head.

Dorsum of thorax green, with more or less distinct metallic brown stripes; acrostichal bristles small, in a somewhat irregular row, beginning near the front of the dorsum; there are from two to four small bristles in a transverse row, beginning at the first dorso-central bristle and extending to a point back of the humeri; pleura with a few pale hairs above the fore coxae, a cluster below the calypters and a fringe on the posterior edge: scutellum with one pair of large marginal bristles and a few delicate pale hairs on the edge. Abdomen coppery, or green with coppery bands at the base of the segments, covered with grayish pollen. Hypopygium nearly concealed, they have very small white lamellae, fringed with minute white hairs.

All coxae and femora metallic green, dulled with white pollen; fore coxae with quite abundant, but short white hair on anterior surface and sometimes with a small black bristle at tip. Middle femora with a row of about eight black bristles, extending for about half the length of the middle of the lower edge, these are longest apically, where they are nearly as long as the width of the femora; hind femora almost black near the tip, they have two preapical bristles, one below the other, the lower one the smaller. All tibiae reddish yellow, the posterior pair gradually thickened and a little darker at tip. Fore and middle tarsi with the first joint yellow or reddish yellow, their tips black; hind tarsi black, first joint (fig. 14) sometimes a little yellowish at base, they are bent, hollowed below, with a pair of hook-like bristles near the base below and also several short straight ones. Joints of fore tarsi as 41–19–15–10–10; of middle pair as 48–21–16–10–10; those of hind tarsi as 32–27–20–13–11. Calypters yellowish white with a narrow brown border and long yellow cilia, which is sometimes brown, especially at base.

Wings tinged with brown, with conspicuous brown spots on the cross-vein and the middle of the last section of fourth vein; length of last section of fifth vein thirty-four, of cross-vein thirty-one, fiftieths of a millimeter.

Female: Differs from the male in having the third antennal joint nearly round with a slight point at tip, just above which the arista is inserted. Face wide, bronze brown, lower portion concave, projecting on lower edge, with a little white pollen, mostly along the lower margin. Fore femora greenish on basal half or more, apical portion yellow; middle and hind femora and all tibiae yellow, posterior femora with a brown spot on upper sur-

face before the preapical bristle. Tarsi colored as in the male, yet the posterior basitarsus is more yellow at base and plain. Wings about as in the male; the last section of the fifth vein is forty, the cross-vein thirty-six, fiftieths of a millimeter.

Redescribed from type material, taken at Cranbrook, British Columbia, May 12; quite a series taken by Mr. Curran at Hull, Quebec in June; three males and one female taken by Dr. J. M. Aldrich in Idaho, May, July and August; and one male taken by E. P. Van Duzee at the Biological Station, at Nanaimo, British Columbia, June 22, 1920.

Some of the western specimens have all the tibiae dark brown, only a little tinged with reddish yellow, and the wings are not tinged with brown, even the spots on the veins being very faint. The Quebec specimens have several small black bristles at tip of fore coxae, the western ones sometimes have one, but more often none, yet I see no reason to separate them from the typical *tricoloripes*.

Syntormon simplicitarse new species

Male: Length, 2.5 mm. Face and front bluish with thin white pollen, the former not very narrow for a male. Palpi and proboscis yellow, antennae (fig. 16) with the first two joints yellow; third joint brown, three times as long as wide; arista about one-third as long as third joint; second joint overlapping third to beyond its basal third. Inferior orbital cilia white.

Dorsum of thorax pea-green, dulled with white pollen, its posterior portion with blue reflections; its hairs and some of its bristles appearing white in certain lights. Abdomen darker green, its hairs black, a few small white hairs on the sides of the first segment; venter yellow. Hypopygium (fig. 15) large, its base yellowish brown, beyond this is a somewhat oval part which is black on basal half, yellow on apical half; it has long, slender, yellow lamellae fringed with hairs and a central filament.

All coxae, posterior edge of pleura, all femora, tibiae and tarsi wholly pale yellow; hairs on the fore coxae white; hairs on the legs and feet small, black. Posterior basitarsi plain and without bristles. Joints of fore tarsi as 30–18–14 8 7; of middle pair as 34–21–13–9–8; joints of hind tarsi as 16–15–17–11–8. Calypters, their cilia and the halteres pale yellow.

Wings a little grayish; third and fourth veins a little more widely separated at the middle of last section of fourth than at tip, yet nearly parallel towards their tips; length of last section of fifth vein twenty-nine, of cross-vein fourteen, fiftieths of a millimeter.

Described from one male, taken by Dr. J. M. Aldrich, at Lafayette, Indiana, May 11, 1916. Type in the United States National Museum.

This is separated from all other of the North American species by its large hypopygium, wholly yellow legs and feet, partly yellow antennae, and its plain hind basitarsi.

It is possible that when the female of this species is found we will have to place it in the genus *Parasyntormon* Wheeler.

A TABULAR ACCOUNT OF THE DIFFERENCES BETWEEN THE EARLIER INSTARS OF PANTALA FLAVESCENS (ODONATA: LIBELLULIDAE)

BY LAURA LAMB

University of Pennsylvania

Aim of Study

The aim of study in this paper was to determine the differences between the larval stages of *Pantala flavescens*, as to size, change, appearance and disappearance of parts, in order to identify the individual stages and to discover in which stages the characteristics of the last instar appear.

The full-grown larva of this species, or its exuvia, has been described by Cabot (1890) and by Needham and Betten (1901), and has again been figured by Needham (1904). Warren (1915) has given notes on the differences in length and duration of the various instars but in no other features. Kennedy (1923) compares the last stage of *Pantala hymenea* with *flavescens*. Balfour Brown (1909) has described the instars of *Agrion pulchellum* and *Ischnura elegans;* Walker (1912) has given, very briefly, characters for the last eight instars of species of *Aeshna;* Tillyard (1917, pp. 73–76) has given some general statements; but we are not aware that any Anisopterous larva has been treated as fully as in the present paper.

Material

All individuals used, except the exuviae of the last instar, developed from a mass of about one hundred and fifty eggs, laid by one individual taken at Primos, Pennsylvania, August 21, 1923. These eggs began hatching September 1, 1923, and continued until October 5. The pronymphal stage was not studied. The individuals were removed from the egg dish and placed in small stender dishes, which were kept in a shaded part of the laboratory. During the first instar, no food was given; during the second and third stages *Paramecium* and small mosquito larvae formed the food. The remaining stages fed upon mosquito larvae and small crustaceans until the tenth

instar, when pieces of earth worms and may-fly larvae were supplied. In the eleventh instar, small fish were eaten. The individuals were kept in separate dishes after the third instar on account of cannibalism. All exuviae and dead material were preserved in alcohol.

But one individual passed beyond the sixth instar, so that the exuviae were the only preserved materials of the later stages. This single individual passed to the eleventh instar and then disappeared by some unknown means from the covered dish in which it was kept. Drawings and photographs had been taken of this instar, but the stages between the eleventh and the last, if such stages exist, were not determined. Drawings by means of the camera lucida and the delineascope were made of the living material, and it is from these drawings, as well as from the preserved material, that the characteristics have been noted. All measurements are from dorsal views and are in millimeters.

The writer is greatly indebted to Dr. Philip P. Calvert for many valuable suggestions and helpful criticisms.

Points of Similarity in the Successive Instars

The following characters of the last instar are found in all instars studied:—The large, prominent mask had nine teeth on each palp, a movable hook was present on the palps of all instars, the legs were long and slender, placed far apart, those of the first pair slightly nearer than the second and third pairs. The tarsi of all legs ended in two long slender claws.

Dates and duration of instars of longest lived individual:

First instar, Sept. 8–14, 6 days. Second instar, Sept. 14–20, 6 days. Third instar, Sept. 20–26, 6 days. Fourth instar, Sept. 26–Oct. 3, 7 days. Fifth instar, Oct. 3–10, 7 days. Sixth instar, Oct. 10–17, 7 days. Seventh instar, Oct. 17–24, 7 days. Eighth instar, Oct. 24–Nov. 2, 9 days. Ninth instar, Nov. 2–13, 11 days. Tenth instar, Nov. 13–27, 14 days. Eleventh instar, Nov. 27–Dec. 8, when it disappeared.

This is a duration of three months, or about ninety days. Warren (1915) says the Hawaiian specimens passed the total number of ten or eleven larval stages in an average of eighty days, varying from sixty-five to one hundred and one days; although he thinks it is doubtful if the average is so short in nature since the food

supply is not always close at hand. Warren also found that the last instar occupied more than one-third the life of the nymph. Therefore the ninety days occupied by my specimens would be not more than two-thirds the life of the nymph, showing that either the cooler climate or the more limited food supply affected the total length of life of the nymph. According to data given by Kennedy (1922) the life of the nymph of *Pantala hymenea* is about three months, and he suggests that one reason for the wide spread of this species, from Canada to the Argentine, may be its ability to mature quickly in shallow pools, and that probably the same is true of *Pantala flavescens*, which is the most widely distributed of all Odonata. The suggestion seems to be supported by my results.

Outline of Contrasting Characters

Points of Contrast	Number in the following list
I. *Head*	
A. Eyes	
Position	1
Markings	2
Size compared to width of head	3
B. Ocelli	4
C. Antenna	
Number of joints	5
Length of joints	6
D. Mask (labium)	
Palps	7
Mentum	8
Mental setae	9
Lateral setae	10
Hairs on tips of teeth	11
E. Size	
Width	12
Length	13
II. *Thorax*	
A. Wing cases	
Size	14
Markings	15

B. Legs
Color
Tarsus 16
Tibia 17
Femur 18
Length of joints
First pair
Femur 19
Tibia 20
Tarsus 21
Second pair
Femur 22
Tibia 23
Tarsus 24
Third pair
Femur 25
Tibia 26
Tarsus 27
Tarsal joints
Number 28
Relative size 29
C. Size
Length 30
Width 31
III. *Abdomen*
A. Color
Black dots 32
Brown or orange markings 33
B. Anal appendages
Parts 34
Relative length 35
Shape 36
C. Lateral spines
Eighth segment 37
Ninth segment 38
D. Arrangement of setae 39
E. Size
Width 40
Length including anal appendages 41
IV. *Total length* 42

First Instar

1. Eyes at side and front of head.
2. Small dark spot near center of eye.
3. Each eye one-seventh total width of head.
4. No ocelli.
5. Four joints to antenna.
6. Total length of antenna equals head. First and second joints short and together equal to third, third and fourth subequal.
7. Palps hatchet-shaped.
8. Anterior edge of mentum straight.
9. No mental setae.
10. One or no lateral setae.
11. No incurved spines on teeth of palps.
12. Width of head of four individuals: (1) .288 mm., (2) .312 mm., (3) .288 mm., (4) .312 mm., Ave.—.364 mm.
13. Length of head of four individuals: (1) .264 mm., (2) .288 mm., (3) .264 mm., (4) .24 mm., Ave.—.264 mm.

14 and 15. No wing cases present.

16, 17 and 18. No color to legs.

19 to 27. One individual measured to obtain proportions between lengths of joints.

First pair: 19. femur—.264 mm. 20. tibia—.288 mm. 21. tarsus—.216 mm.

Second pair: 22. femur—.264 mm. 23. tibia—.288 mm. 24. tarsus—.216 mm.

Third pair: 25. femur—.312 mm. 26. tibia—.312 mm. 27. tarsus—.216 mm.

28. One tarsal joint.
30. Length of thorax of four individuals: (1) .312 mm. (2) .336 mm., (3) .336 mm., (4) .288 mm., Ave.—.318 mm.
31. Width of thorax of four individuals: (1) .288 mm., (2) .312 mm., (3) .288 mm., (4) .316 mm., Ave.—.3 mm.
32. No black dots on abdomen.
33. No brown or orange markings.
34. The anal appendages consist of the mid-dorsal, and two inferiors; within these appear the sub-anal laminae, parts of the twelfth segment.
35. Inferiors longest.
36. Inferiors are sharp and very hairy: the mid-dorsal is broad and suddenly becomes very sharp.

37. Eighth segment has no spine.
38. Ninth segment has no spine.
39. Four setae were present on the first, second, third, and tenth abdominal segments; on the fourth, fifth, sixth, seventh, eighth, ninth, six setae were present.
40. Width of abdomen of four individuals: (1) .288 mm., (2) .348 mm., (3) .312 mm., (4) .336 mm., Ave.—.321 mm.
41. Length of abdomen of four individuals: (1) .864 mm., (2) .840 mm., (3) .812 mm., (4) .672 mm., Ave.—.798 mm.
42. Total length of four individuals: (1) 1.44 mm., (2) 1.464 mm., (3) 1.416 mm., (4) 1.2 mm., Ave.—1.38 mm.

Second Instar

1. Eyes at side and front of head.
2. Small dark spot near center of eye, facets present on lateral half of eye, not on inner half.
3. Each eye one-seventh total width of head.
4. No ocelli.
5. Antennae four-jointed.
6. Total length of antenna equals head. First and second joints together equal third, third and fourth subequal.
7. Palps more triangular.
8. Mentum is large, hollowed transversely, edges incurved.
9. Two mental setae on each side.
10. One or no lateral setae.
11. No palpal hairs on the first, second, third, fourth, fifth, sixth palpal teeth, counting from the movable hook; one hair indicated on the seventh, eighth, and ninth.
12. Width of head of four individuals: (1) .528 mm., (2) .576 mm., (3) .504 mm., (4) .48 mm., Ave.—.522 mm.
13. Length of head of four individuals: (1) .336 mm., (2) .408 mm., (3) .408 mm., (4) .36 mm., Ave.—.378 mm.

14 and 15. No wing cases.

16. Tarsi of all legs are pale.

17 and 18. Femur and tibia each have two rings of gray.

19 to 21. One individual measured for proportions of joints: first pair: femur—.312 mm., tibia—.36 mm., tarsus—.216 mm.

22 to 24. Second pair: femur—.336 mm., tibia—.384 mm., tarsus—.216 mm.

25 to 27. Third pair: femur—.388 mm., tibia—.432 mm., tarsus—.336 mm.

28. One tarsal joint.
30. Length of thorax of four individuals: (1) .36 mm., (2) .408 mm., (3) .384 mm., (4) .332 mm., Ave.—.371 mm.
31. Width of thorax of four individuals: (1) .432 mm., (2) .432 mm., (3) .36 mm., (4) .312 mm., Ave.—.384 mm.
32. No black dots on abdomen.
33. No markings on abdomen.
34. Abdominal appendages consist of a mid-dorsal and two inferiors.
35. Inferiors longest, but not longer than the ninth and tenth abdominal segments.
36. Mid-dorsal sharp, broad and hairy.
37. Eighth segment has no lateral spine.
38. Ninth segment has no lateral spine.
39. Arrangement of setae on abdominal segments: first segment —two setae, second—four, third—six, fourth—six, fifth —eight, sixth—eight, seventh—eight, eighth—six, ninth —six, tenth—none.
40. Width of abdomen of four individuals: (1) .48 mm., (2) .312 mm., (3) .456 mm., (4) .408 mm., Ave.—.414 mm.
41. Length of abdomen of four individuals: (1) .888 mm., (2) .96 mm., (3) 1.2 mm., (4) 1.128 mm., Ave.—1.044 mm.
42. Total length of the four individuals: (1) 1.584 mm., (2) 1.776 mm., (3) 1.992 mm., (4) 1.848 mm. Ave.—1.8 mm.

Third Instar

1. Eyes anterior and lateral.
2. Facets and dark spot in the center.
3. Each eye one-sixth width of head.
4. No ocelli.
5. Five antennal joints.
6. Length of first and second joints equals third, third and fourth are subequal.
7. Palps are triangular.
8. Mentum large, anterior edge angular.
9. Mental setae are four on each side.
10. Four lateral setae.
11. No hairs on first and second palpal teeth, counting from the movable hook, one hair on each of the remaining teeth.
12. Width of head of four individuals: (1) .648 mm., (2) .768 mm., (3) .672 mm., (4) .673 mm. Ave.—.69 mm.

13. Length of head of four individuals: (1) .48 mm., (2) .528 mm., (3) .528 mm., (4) .432 mm. Ave.—.492 mm.
14 and 15. No wing cases.
16. Tarsi of all legs pale.
17 and 18. Two rings of gray on both tibia and femur.
19 to 21. Length of joints of the legs of one individual: First pair: femur—.288 mm., tibia—.432 mm., tarsus—.288 mm.
22 to 24. Second pair: femur—.432 mm., tibia—.48 mm., tarsus—.264 mm.
25 to 27. Third pair: femur—.624 mm., tibia—.576 mm., tarsus—.24 mm.
28. Tarsi have one joint.
30. Length of thorax of four individuals: (1) .432 mm., (2) .48 mm., (3) .408 mm., (4) .432 mm. Ave.—.438 mm.
31. Width of thorax of four individuals: (1).432 mm., (2) .48 mm., (3) .456 mm., (4) .432 mm. Ave.—.45 mm.
32. No black dots on abdomen.
33. No markings on abdomen.
34. Abdominal appendages consist of a mid-dorsal and two inferiors.
35. Inferiors are longer than mid-dorsal.
36. Mid-dorsal broad and sharp, inferiors slender and sharp.
37. Eighth abdominal segment has no lateral spine.
38. Ninth abdominal segment has lateral spine indicated by slight point.
39. Arrangement of setae not definite on material, since some spines had been lost. Many more setae than in the second stage, apparently arranged as follows: first segment—two setae, second—four, third—six, fourth—eight, fifth—ten, sixth—fourteen, seventh—twelve, eighth—ten, ninth—six, tenth—four very small.
40. Width of abdomen of four individuals: (1) .552 mm., (2) .672 mm., (3) .576 mm., (4) .672 mm. Ave.—.618 mm.
41. Length of abdomen: (1) 1.44 mm., (2) 1.344 mm., (3) 1.224 mm., (4) 1.128 mm. Ave.—1.281 mm.,
42. Total length of four individuals: (1) 2.352 mm., (2) 2.352 mm., (3) 2.184 mm., (4) 1.992 mm. Ave.—2.2 mm.

Fourth Instar

1. Eyes lateral, covering the side of the head.
2. Facets and one dark spot on the center of the eye.

3. Each eye is one-fifth width of the head.
4. No ocelli.
5. The antennae have five joints.
6. The first and second together equal the third in length. The third and fourth are sub-equal.
7. The palps are triangular.
8. The mentum is large, the anterior edge is angular.
9. Six mental setae are on each side.
10. Five lateral setae on each side.
11. The first tooth beyond the movable hook has no incurved hairs, the other eight each have one hair.
12. Width of head of three individuals: (1) .48 mm., (2) .552 mm., (3) .672 mm. Ave.—.568 mm.
13. Length of head. (1) .60 mm., (2) .567 mm., (3) .672 mm. Ave.—.616 mm.

14 and 15. No wing cases.

16. Tarsi of all legs pale in color.

17 and 18. Femur and tibia each have two rings of gray.

19 to 21. Length of joints of first pair of legs: femur—.576 mm., tibia—.552 mm., tarsus—.288 mm.

22 to 24. Length of joints of second pair: femur—.672 mm., tibia—.672 mm., tarsus—.384 mm.

25 to 27. Length of joints, third pair of legs: femur—.768 mm., tibia—.768 mm., tarsus—.432 mm.

28. One tarsal joint.
30. Length of thorax of three individuals: (1) .60 mm., (2) .552 mm., (3) .672 mm. Ave.—.608 mm.
31. Width of thorax of three individuals: (1) .48 mm., (2) .552 mm., (3) .673 mm. Ave.—.568 mm.
32. No black dots on abdomen.
33. Gray markings on abdomen.
34. Anal appendages consist of a mid-dorsal and two inferiors.
35. Inferiors longer than mid-dorsal.
36. Mid-dorsal short and broad, inferiors more slender.
37. No lateral spine on the eighth segment.
38. A lateral spine on each side of the ninth segment.
39. The number of setae on each segment seemed to increase, although individuals appeared to vary. These are the average numbers: first segment—two, second—four, third—six, fourth—ten, fifth—twelve, sixth—sixteen, seventh—fourteen, eighth—twelve, ninth—eight, tenth—four very small.

40. Width of abdomen of three individuals: (1) .648 mm., (2) .864 mm., (3) 1.128 mm.
41. Length of abdomen of three individuals: (1) 1.585 mm., (2) 1.68 mm., (3) 2.976 mm. Ave.—1.632 mm.
42. Total length of individuals: (1) 2.784 mm., (2) 2.784 mm., (3) 2.976 mm., Ave.—2.848 mm.

Fifth Instar

1. Eyes are lateral, covering sides of the head.
2. The facets and dark spot are present.
3. The eyes are one-fourth width of the head.
4. No ocelli are indicated.
5. Five antennal joints are present.
6. The first and second joints are small and together equal third in length. The third is longer than the fourth, while third and fourth together equal the fifth in length.
7. Palps are triangular in shape.
8. Mentum is large, the anterior edge is angular in shape.
9. Seven or eight mental setae on each side.
10. Six lateral setae on each side.
11. There are no hairs on the tip of the first palpal tooth, counting from the movable hook, one hair on the second, third, sixth, seventh, eighth, ninth; the fourth and the fifth have two.
12. Width of head of two individuals: (1) 1.538 mm., (2) 1.537 mm. Ave.—1.537 mm.
13. Length of head of two individuals: (1) .816 mm., (2) .888 mm. Ave.—.852 mm.
14. The knobs representing both pairs of wing cases appear.
15. No veins nor markings are present on the wing cases.
16. All tarsi are pale in color.

17 and 18. Two rings of dark gray are present on both tibia and femur.

19 to 21. The length of joints of the first pair of legs: femur—.72 mm., tibia—.576 mm., tarsus—.432 mm.

22 to 24. Length of joints of second pair of legs: femur—.864 mm., tibia—.6 mm., tarsus—.432 mm.

25 to 27. Length of joints of third pair of legs: femur—1.032 mm., tibia—.752 mm., tarsus—.504 mm.

28 and 29. One tarsal joint.

30. Length of thorax of two individuals: (1) .768 mm., (2) .766 mm. Ave.—.767 mm.

31. Width of thorax of two individuals: (1) .768 mm., (2) .768 mm. Ave.—.768 mm.
32. No black dots on abdominal segments.
33. Gray markings on second to ninth abdominal segments.
34. The anal appendages consist of a mid-dorsal, two inferiors, and two laterals now first appearing.
35. The inferiors are the longest. The laterals are very short.
36. Mid-dorsal broad and sharp, the inferiors more slender.
37. The lateral spine appears on the eighth abdominal segment.
38. The lateral spine on the ninth abdominal becomes longer.
39. The setae are present and more numerous than in preceding instars; on first and second segments none discernible, on third and fourth—six short and distinct, on fifth—six long and ten short, on sixth—six long and eighteen short, on seventh—four long, twelve short, on eighth—six long and eight short, on ninth—six long, on tenth—none.
40. Width of abdomen of two individuals: (1)1.464 mm., (2) 1.464. Ave.—1.464 mm.
41. Length of abdomen of two individuals: (1) 2.112 mm., (2) 2.412 mm. Ave.—2.262 mm.
42. Total length of two individuals: (1) 3.796 mm., (2) 4.066 mm.

Sixth Instar

1. Eyes cover lateral part of head.
2. Dark spot and facets are present.
3. Each eye is one-fourth width of head.
4. No ocelli are indicated.
5. Six antennal joints are present.
6. First and second antennal joints together equal third in length, third and fourth are sub-equal.
7. Palps are triangular in shape.
8. Mentum is large, the anterior edge is angular in shape.
9. Nine or ten mental setae on each side.
10. Eight lateral setae on each side.
11. No hairs on the first palpal tooth, counting from the movable hook, one hair on the second and third teeth, two hairs on each of the remaining teeth.
12. Width of head of one individual—1.776 mm.
13. Length of head—1.032 mm.
14. Wing cases are small knobs.
15. No markings on the wing cases.

16. Tarsus of the first pair of legs is pale, of the second and third is dark.
17 and 18. Tibia and femur are each marked with two rings of gray.
19 to 21. Length of joints of first pairs of legs: femur—1.56 mm., tibia—1.248 mm., tarsus—.672 mm.
22 to 24. Length of joints of the second pair of legs: femur—1.752 mm., tibia—1.44 mm., tarsus—.672 mm.
25 to 27. Length of joints of third pair of legs: femur—1.8 mm., tibia—1.68 mm., tarsus—.768 mm.
28. Two tarsal joints.
29. The second tarsal joint is more than four times the length of the first.
30. Length of thorax of one individual—.916 mm.
31. Width of the thorax—1.296 mm.
32. The eighth and ninth abdominal segments each have two black dots.
33. Orange marks appear on the anal appendages and on the lateral spines.
34. Anal appendages consist of a mid-dorsal, a pair of inferiors, and a pair of laterals.
35. The inferiors are longest, the mid-dorsal slightly shorter, and the laterals very short.
36. Mid-dorsal broad and sharp, inferiors longer but similar in shape, laterals slender.
37 and 38. Spine on eighth segment very short, on ninth longer, its length equals that of the mid-dorsal anal appendage.
39. The arrangement of the setae was not clearly determined on account of scarcity of material.
40. Width of abdomen—1.992 mm.
41. Length of abdomen—2.952 mm.
42. Total length—4.896 mm.

Seventh Instar

1. The eyes cover the sides of the head.
2. The facets and dark spot are present.
3. Each eye is one-fourth the total width of the head.
4. Ocelli are indicated by markings.
5. Seven antennal joints are present.
6. The first and second antennal joints are small and together equal the third in length. The others are sub-equal, the fourth and fifth are the shortest.

7. The palps are triangular and large.
8. The mentum is large and its anterior edge is angular.
9. Ten or eleven mental setae are on each side.
10. Eight or nine lateral setae are on each side.
11. No hairs are on the first palpal tooth, counting from the movable hook, one hair on the second and third teeth, two hairs on each of the others.
12. Width of head is 2.4 mm.
13. Length of head is 1.344 mm.
14. The wing cases are longer.
15. The tips of the wing cases are brown.
16. The tarsi of the first legs are pale, those of the second and third are dark gray.

17 and 18. The tibia and femur of all pairs of legs have two rings of gray.

19 to 21. Length of joints of the first pair of legs: femur—.96 mm., tibia—1.008 mm., tarsus—.768 mm.

22 to 24. Length of joints of the second pair of legs: femur—1.44 mm., tibia—1.57 mm., tarsus—.792 mm.

25 to 27. Length of joints of the third pair of legs: femur—1.8 mm., tibia—1.57 mm., tarsus—.792 mm.

28. Two tarsal joints on each leg.
29. The second is five times as long as the first.
30. The length of the thorax is 1.248 mm.
31. Width of the thorax is 1.68 mm.
32. Black dots are arranged on the abdominal segments as follows:—two dots on the second, third, fourth and ninth; four dots on the fifth, sixth, seventh and eighth.
33. Orange color on the anal appendages and the lateral spines. Brown spots on the central part of the second and third abdominal segments.
34. The anal appendages consist of a mid-dorsal appendage, one pair of inferiors and a pair of laterals.
35. The mid-dorsal and the inferiors are subequal and are longer than the ninth plus the tenth abdominal segments.
36. The mid-dorsals are broad and suddenly pointed, the inferiors are similar, the laterals short and more slender.
37. The lateral spines on the eighth segment are very short,
38. The lateral spines on the ninth segment are as long as the mid-dorsal appendage.
39. The setae were not clearly seen on account of scarcity of material.

40. The width of the abdomen is 2.496 mm.
41. The length of the abdomen is 4.738 mm.
42. The total length is 7.33 mm.

Eighth Instar

1. The eyes cover the sides of the head.
2. The facets and dark spot are present.
3. Each eye is one-fourth of the width of the head.
4. Three ocelli are indicated.
5. Seven antennal joints are present.
6. The first and second joints are thicker than the others and together equal the third in length; the fourth and fifth are subequal and smaller than the sixth or seventh.
7. The palps are triangular.
8. The mentum is large and the anterior edge is angular.
9. There are twelve mental setae on each side.
10. There are nine or ten lateral setae on each side.
11. There is one hair on the first palpal tooth, counting from the movable hook; two hairs on the second, third and ninth teeth; three hairs on the fourth, fifth, seventh, and eighth; four hairs on the sixth.
12. Width of head is 2.568 mm.
13. Length of head is 1.704 mm.
14. The first pair of wing cases extends to the line joining the posterior edge of the third pair of legs, the second pair of wing cases extends to the first abdominal segment.
15. The markings on the wing cases consist of longitudinal brown stripes.
16. The tarsi of the first pair of legs are pale, of the second and third pair are dark.

17 and 18. The tibia and femur of all legs have two dark rings.

19 to 21. The length of joints of the first pair of legs: femur—1.44 mm., tibia—1.728 mm., tarsus—lost before measuring.

22 to 24. Length of joints of the second pair of legs: femur—1.92 mm., tibia—2.184 mm., tarsus—1.128 mm.

25 to 27. Length of joints of the third pair of legs: femur—2.64 mm., tibia—2.352 mm., tarsus—lost before measuring.

28. Three tarsal joints are present.
29. The second joint is twice the first and the third joint is three times the first.
30. The length of the thorax is 1.68 mm.

31. The width of the thorax is 2.064 mm.
32. Two black dots are on the third, fourth and ninth abdominal segments. Four dots are on the fifth, sixth, seventh and eighth.
33. There are brown markings on the second and third segments. The mid-dorsal and lateral spines are edged with orange.
34. The anal appendages consist of a mid-dorsal, a pair of laterals and a pair of inferiors.
35. The mid-dorsal is about the same length as the inferiors, and these are twice the length of the laterals.
36. The mid-dorsal is broad at the base and narrows suddenly, the inferiors are similar, the laterals are thorn-shaped.
37. The pair of lateral spines on the eighth segment are very short, one-third the length of the segment.
38. The lateral spines on the ninth segment are longer, one and one-half times the length of the segment.
39. The setae were not in good condition on the specimen.
40. Width of abdomen is 3.24 mm.
41. Length of the abdomen is 4.776 mm.
42. Total length of individual is 8.16 mm.

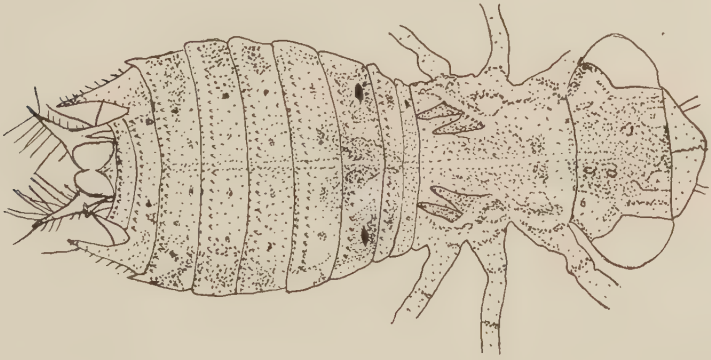


Fig. 1.—Eighth instar. Drawn from living material, Oct. 26, 1923.

Ninth Instar

1. Eyes cover the lateral part of the head.
2. The facets, the central spot and dorso-ventral stripes are present.
3. Each eye is one-fourth of the total width of head.

4. Three ocelli are indicated by markings.

5 and 6. There are seven antennal joints; these were measured to show the proportions: first—.12 mm., second—.192 mm., third—.288 mm., fourth—.15 mm., fifth—.192 mm., sixth—.210 mm., seventh—.216 mm.

7. Palps are triangular.

8. Mentum is large and the anterior edge is angular.

9. Thirteen mental setae on each side.

10. Eleven lateral setae on each side.

11. The first palpal tooth, counting from the movable hook, has one hair; the second, third, fourth, and ninth have two hairs each, and the sixth has four hairs.

12. Width of head is 3.678 mm.

13. Length of head is 2.04 mm.

14. The wing cases are larger, the first pair extending over the first abdominal segment, the second pair extending over the second abdominal segment.

15. Markings on the wing cases consist of longitudinal brown lines and a brown spot.

16. The tarsi of the first pair of legs are pale, of the second and third pairs are dark.

17 and 18. The tibia and femur are pale with two rings of dark gray on each.

19 to 21. The length of joints of the first pair of legs: femur—1.92 mm., tibia—2.04 mm., tarsus—1.2 mm.

22 to 24. Length of joints of the second pair of legs: femur—2.4 mm., tibia—2.472 mm., tarsus—1.224 mm.

25 to 27. Length of joints of the third pair of legs: femur—3.246 mm., tibia—2.88 mm., tarsus—1.368 mm.

28. There are three tarsal joints.

29. The second tarsal joint is twice the first, the third is three times the first.

30. The length of thorax is 1.92 mm.

31. The width of thorax is 3.24 mm.

32. Two black dots are on the third and ninth abdominal segments; four dots are on the fourth, fifth, sixth, seventh, and eighth.

33. There are brown spots on the second and third abdominal segments; there is orange on the anal appendages and on the lateral spines.

34. The anal appendages consist of the mid-dorsal, a pair of inferiors, and a pair of laterals.

35. The mid-dorsal and the inferiors are subequal, the laterals are one-half the length of the inferiors.
36. The mid-dorsal and the inferiors are broad at the base and narrow suddenly to become sharp, the laterals are thorn-shaped.
37. The lateral spines on the eighth segment are very short, one-half the length of the segment in length.
38. The lateral spines on the ninth segment are twice the length of the ninth segment.
39. Arrangement of setae not determined on account of lack of material.
40. Width of abdomen is 4.608 mm.
41. Length of abdomen is 6.72 mm.
42. Total length of individual is 10.68 mm.

Tenth Instar

1. The eyes cover the lateral part of the head.
2. The facets, dark spot, and dorso-ventral stripes are present.
3. Each eye is one-fourth of the total width of the head.
4. Three ocelli are indicated by markings.
5. There are seven antennal joints.
6. The length of the first and second equals the third, the fourth and fifth are shorter than the third or than the sixth or seventh.
7. The palps are triangular.
8. The mentum is large, the anterior edge is angular in shape.
9. There are fourteen or fifteen mental setae on each side.
10. There are eleven or twelve lateral setae on each side.
11. The first palpal tooth, counting from the movable hook, has one hair; the second has two hairs; the third, fourth, and ninth have three; the fifth, sixth, seventh, and eighth have four hairs.
12. Width of head is 3.84 mm.
13. Length of head is 2.40 mm.
14. The second pair of wing cases extends to the fourth abdominal segment. The first pair extends over the third abdominal segment.
15. On each wing case are brown longitudinal lines and a dark spot.
16. The tarsi of the first pair of legs are pale, those of the others are dark.

17 and 18. The femur and the tibia of all legs have two rings of dark gray.

19 to 21. The length of joints of the first pair of legs are: femur —2.324 mm., tibia—2.856 mm., tarsus—1.596 mm.

22 to 24. The length of joints of the second pair of legs: femur— 2.94 mm., tibia—3.08 mm., tarsus—1.512 mm.

25 to 27. Length of joints of the third pair of legs: femur— 3.976 mm., tibia—3.64 mm., tarsus—1.624 mm.

28. Three tarsal joints.

29. In all legs the second tarsal joint is twice the length of the first, and the third is three times the length of the first.

30. Length of the thorax is 2.688 mm.

31. Width of the thorax is 3.12 mm.

32. The first, second, and third abdominal segments are covered by the wing cases and cannot be seen. On the fourth are two dots; on the fifth, sixth, seventh, and eighth are four black dots; on the ninth are two.

33. The anal appendages and the lateral spines are edged with orange.

34. The anal appendages consist of a mid-dorsal, a pair of inferiors, and a pair of laterals.

35. The mid-dorsal and the inferiors are sub-equal and are twice as long as the laterals.

36. The laterals are more thorn-shaped than the mid-dorsal or the inferiors which are broad at the base.

37. The lateral spines on the eighth segment are small, one-half the length of the segment.

38. The spines on the ninth are long, twice the length of the segment.

39. The arrangement of setae was not determined on account of the scarcity of material.

40. Width of abdomen is 5.232 mm.

41. The length of the abdomen is 8.976 mm.

42. The total length of the individual is 14.044 mm.

Eleventh Instar

Due to loss of material, no measurements were made and some characters could not be noted.

1. Eyes occupy the lateral part of the head.
2. The facets and the dorso-ventral lines are present.
3. Each eye is one-fourth of the width of the head.

4. The ocelli are indicated by markings.
5. Seven antennal joints.
14. First wing case extends to the middle of the fourth segment. The second wing case extends over the fifth segment.
15. Darkened areas and a dark spot are on each wing cover.
16. The tarsi of the first legs are pale, those of the others are dark.
17 and 18. The femur and tibia of all legs each have two dark rings, and the femur is darkened at its extremities.
32. Four black dots are on each of these abdominal segments:—fourth, fifth, sixth, seventh, and eighth; on the ninth are two large dots.
34. The anal appendages consist of a mid-dorsal, a pair of inferiors, and a pair of laterals.
35. The mid-dorsal and the inferiors are subequal, the laterals are one-half their length.
36. The mid-dorsal and the inferiors are broad at the base and then suddenly pointed. The laterals are thorn-shaped.
37. The lateral spine on the eighth segment is short, about one-half length of the segment.
38. The lateral spine of the ninth segment is as long as the inferior appendage.

Exuviae of the Last Instar

(Collected at Primos, Pennsylvania, September 9, 1915.)

1. Eyes cover the lateral sides of the head and are egg-shaped.
2. Facets are present.
3. Each eye is one-fourth of the total width of the head.
4. Ocelli are indicated.
5. Seven antennal joints are present.
6. The second joint of the antennae is twice the first, the fourth plus the fifth equals the third, the sixth and the seventh are each longer than either the fourth or the fifth.
7. Palps are triangular.
8. The mentum is large.
9. There are seventeen mental setae.
10. Lateral setae are thirteen on each side.
11. On the first and second palpal teeth are two hairs; on third, three hairs; on fourth, fifth, sixth, seventh, eighth, and ninth are four hairs.
12. Width of head of four exuvia: (1) 7 mm., (2) 6.5 mm., (3) 6 mm., (4) 6.5 mm. Ave.—6.5 mm.

13. Length of head: (1) 3 mm., (2) 4 mm., (3) 4 mm., (4) 4 mm. Ave.—3.66 mm.
14. The first and the second pair of wing cases extend over the sixth abdominal segment.
15. Veins are visible on the wing cases, and these are covered by brown lines.
16. Tarsi of the first legs pale, the others dark.
17 and 18. The femur and the tibia of all legs each have two rings of gray.
19 to 21. Length of joints of the first pair of legs: femur—5 mm., tibia—4.5 mm., tarsus—2.5 mm.
22 to 24. Length of joints of the second pair of legs: femur—6 mm., tibia—5 mm., tarsus—2.5 mm.
25 to 27. Length of joints of the third pair of legs: femur—8 mm., tibia—6 mm., tarsus—2.5 mm.
28. Three tarsal joints are present.
29. The second tarsal joint is twice the first and the third is three times the first.
30. Length of thorax of four exuviae: (1) 5 mm., (2) 6 mm., (3) 5 mm., (4) 5 mm. Ave.—5.2 mm.
31. Width of thorax of four exuviae: (1) 5 mm., (2) 5 mm., (3) 5 mm., (4) 6 mm. Ave.—5.2 mm.
32. The ninth abdominal segment has two dots, the fourth to the eighth have four dots.
34. The anal appendages consist of a mid-dorsal, a pair of laterals, and a pair of inferiors.
35. The mid-dorsal a little longer than the inferiors, the laterals are two-thirds the length of the inferiors.
36. Mid-dorsal is wide at the base, its upper edge forms a keel.
37. The spine on the eighth segment reaches the posterior edge of the ninth segment.
38. The spines on the ninth segment are as long as the inferior anal appendages.
39. No setae were noted.
40. Width of abdomen of four exuviae: (1) 9 mm., (2) 8.5 mm., (3) 8 mm., (4) 9 mm. Ave.—8.6 mm.
41. Length of abdomen of four exuviae: (1) 17 mm., (2) 14 mm., (3) 16 mm., (4) 16.5 mm. Ave.—15.87 mm.
42. Total length of four exuviae: (1) 25 mm., (2) 24 mm., (3) 25 mm., (4) 25.5 mm. Ave.—24.87 mm.

Tentative Key to Instars

a.—Wing cases and lateral anal appendages absent.
b.—Antennal joints four.
c.—Mental setae absent.....First instar
cc.—Mental setae present.....Second instar
bb.—Antennal joints five.
d.—No lateral spines on eighth nor ninth segment. Third instar
dd.—Lateral spine on the ninth segment....Fourth instar
aa.—Wing cases and lateral anal appendages present.
b.—Tarsal joint—one.....Fifth instar
bb.—Tarsal joints two or three.
c.—Tarsal joints—two.
d.—Mental setae—nine or ten, lateral setae—eight. Sixth instar
dd.—Mental setae—ten or eleven, lateral setae—nine. Seventh instar
cc.—Tarsal joints—three.
e.—Veins of wing cases absent.
f.—Dark spot on wing case absent...Eighth instar
ff.—Dark spot on wing case present.
g.—Wing cases do not extend to the fifth abdominal segment.
h.—Mental setae—thirteen, lateral setae—eleven. Ninth instar
hh.—Mental setae—fourteen, lateral setae—twelve.....Tenth instar
gg.—Wing cases extend over the fifth abdominal segment.....Eleventh instar
ee.—Veins of wing cases present.....Last instar

Summary

The following changes occur during the growth and development of the larva, numbered to correspond with the preceding lists.

2. Facets of the compound eye appear first in the second instar and continue to increase to metamorphosis.
3. The width of each eye increases in relation to that of the head from one-seventh in the first instar to one-fourth in the fifth and later instars.

4. Ocelli are first indicated in the seventh instar.
5. The antennal joints increase from four in the first and second to five in the third, fourth, and fifth, six in the sixth, seven in the seventh and later instars.
6. The relative length of the first three antennal joints remains the same, the fourth antennal joint changes from subequal to the third in the fourth instar to less than one-half its length in the tenth and later instars. The fifth joint changes from the longest in the fifth instar to less than one-half the third in the tenth and later instars.
9. The number of mental setae increases from none in the first instar to two in the second, four or five in the third, six in the fourth, seven or eight in the fifth, nine or ten in the sixth, ten or eleven in the seventh, twelve in the eighth, thirteen in the ninth, fourteen or fifteen in the tenth, and seventeen in the last.
10. The number of lateral setae increases from none in the first and second to four in the third, five in the fourth, six in the fifth, eight in the sixth, nine in the seventh, nine or ten in the eighth, eleven in the ninth, twelve in the tenth, and thirteen in the last.
11. The number of hairs on the palpal teeth increases from none in the first instar to from two to four on each palpal tooth in the last instar. (Note:—The numbers given in sections 9, 10, and 11, might vary more if a larger number of individuals had been available for study.)
14. The wing cases appear in the fifth stage as mere knobs and increase in length until the last stage, where they extend over the sixth abdominal segment.
16. The color of the tarsi of the first legs remains pale, the tarsi of the second and third pairs are pale until the sixth stage, where they become dark gray or black and continue so until the end.
28. The tarsal joints increase from one in the first five stages to two in the sixth and seventh, and three in the remaining instars.

32 and 33. The color and markings on the abdomen changes from none in the first four instars to complicated designs and dots in the later instars.

35. The laterals of the anal appendages appear in the fifth instar, and increase until the last instar, where they are two-thirds the length of the inferiors.
39. The arrangement of the setae on the abdomen changes, but insufficient material prevented definite study after the fourth instar.

Bibliography

Balfour-Brown, Frank. 1909. The Life History of the Agrionid Dragonfly. Proceedings of the Zoological Society of London, 1909, pp. 253–285.

Cabot, Louis. 1890. Immature State of Odonata. Part III, Sub-family Cordulina. Memoirs of the Museum of Comparative Zoology, xvii, no. 1, pp. 43–44.

Kennedy, Clarence H. 1923. The Naiad of Pantala Hymenea (Odonata). The Canadian Entomologist, lv, no. 2, pp. 36–37.

Needham, James G., and Betten, Cornelius. 1901. Aquatic Insects in the Adirondacks. New York State Museum Bulletin, no. 47, pp. 539–540.

Needham, James G. 1904. The New Dragonfly Nymphs in the National Museum. Proceedings of the United States National Museum, xxvii. p. 712.

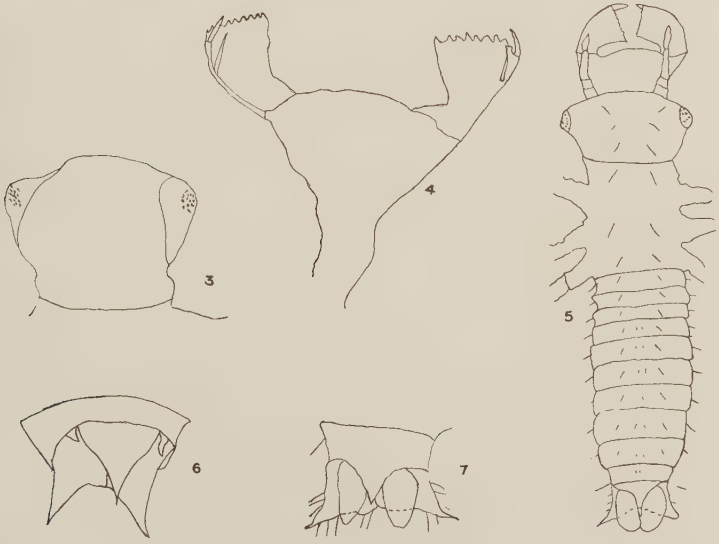
Tillyard, R. J. 1917. The Biology of Dragonflies (Odonata or Paraneuroptera). Cambridge University Press. Pp. 73–76.

Walker, E. M. 1912. The North American Dragonflies of the Genus Aeschna. University of Toronto Biological Series, no. 11, pp. 46–49.

Warren, Alfred. 1915. A Study of the Food Habits of the Hawaiian Dragonflies or Pinau in Reference to their Economic Relation to Other Insects. College of Hawaii Publications, Bulletin no. 3, pp. 5–13.

Explanation of Plate X

Fig. 2.—Eleventh instar. Photographed Dec. 1, 1923, from living material.
Fig. 3.—Eye of the first instar.
Fig. 4.—Mask of the first instar.
Fig. 5.—First instar.
Fig. 6.—Anal appendages of the fifth instar.
Fig. 7.—Anal appendages of the first instar.
Figures 3, 4, 5, 6 and 7 were drawn from dead material.



LAMB—INSTARS OF PANTALA FLAVESCENS (ODONATA).

STUDIES IN THE MELYRIDAE (COLEOPTERA)

NUMBER FOUR

BY FRANK E. BLAISDELL, SR.

San Francisco, California

At the present time I wish to make known the following three new species of Melyridae from the collection of Mr. Chas. Liebeck of Philadelphia.

Listrus sinuatus new species

Form oblong-oval, parallel, moderately convex and about two and three-fourths as long as wide. Color black with a very feeble aeneous tinge; antennae and legs piceous. Moderately shining.

Pubescence sparse and moderate in length, the elytral pattern of maculation not distinct. Color dull cinereous with indefinite areas of fuscous. Hairs longer and finer on the abdomen. Lateral pronotal fimbriae of moderate length, rather close-set and even; those of the elytra similar in length, slightly more widely spaced and quite equal in length throughout.

Head somewhat transverse, muzzle rather short; front broadly impressed, very feebly convex along the median third behind the epistoma; punctures rather strong, round and well defined, somewhat irregular, separated by a distance equal to one-half to about their diameter, small glabrous areas may be present. Eyes large and strongly convex, with very short setae as usual. Antennae slender, feebly incrassate, not serrate and extending to about base of the pronotum; second joint oval, a little longer than wide and slightly narrowed at base, third almost cylindrical and relatively slender, about two and a half times as long as wide; fourth and fifth quite similar in form, subtriangular, the latter a little wider than the former, subequal in length and a little longer than wide; sixth, seventh and eighth quite similar in form, triangular and symmetrical, more rounded in transverse section and about as long as wide; ninth and tenth slightly shorter and rounded in section, each subequal in length to the eighth; eleventh not wider than the tenth, pointed oval, slightly compressed apically and less than twice as long as wide.

Pronotum about a fourth wider than long, apex truncato-arcuate in moderate circular arc; base broadly arcuate, straighter and oblique in lateral thirds; sides moderately and evenly but

not strongly arcuate in basal half, thence a little convergent and less arcuate to apex, serrulations distinct and acute; apical angles moderately strongly rounded, sides broadly rounding into the base with the basal angles indicated by a rather large serrule; disk moderately and evenly convex from side to side, slightly more declivous antero-laterally, punctures rather large, sharply defined and slightly perforate, separated by a distance equal to one-half to their own diameter, intervening surface smooth with an occasional punctule; a small glabrous spot is usually present on the median line near base.

Elytra oblong and slightly flattened on the dorsum, apex rather parabolically rounded; base scarcely emarginate and as wide as the pronotum; humeri slightly tumid and moderately rounded; punctures rather less strong than on the pronotum, not sharply defined, separated by a distance equal to one or two times their diameter, surface rather obsoletely transversely rugose.

Abdomen finely and densely punctate, finely ruguloso-punctate on the fifth segment; less than moderately convex, hairs longer and denser apically and brownish in color. Fifth ventral segment sinuato-truncate, slightly flattened, otherwise unmodified.

Legs slender and moderate in length; metafemora not tumid.

Measurements.—Length, 2.8 mm.; width, 1 mm.

Holotype, male, in the author's collection; one paratype, male, in that of Mr. Chas. Liebeck.

Type locality.—California.

Sinuatus is most closely related to *dilutus* Blaisdell, which it resembles in color of pubescence and character of maculation. In *dilutus* the antennae of the male are stouter, the femora more tumid and the metafemora are quite strongly narrowed toward the trochanters; the fifth ventral segment of the male is quite distinctly truncate at apex and the pubescence is not noticeably longer or denser.

Listrus obsoletus new species

Form oblong-suboval, elongate, about three times as long as wide and moderately convex. Color black with a more or less aeneous tinge; antennae rufous, basal joint black, distal joints rufo-piceous; femora piceous, tibiae and tarsi rufous.

Pubescence easily denuded, very sparse and inconspicuous, nearly recumbent, moderately short; color dull cinereous and fuscous intermixed, a distinct pattern of maculation not discernible, although the brownish hairs are more abundant in

some areas than in others. Lateral pronotal fimbriae moderately short, regular and close-set; those of the elytra similarly cinereous in color, more widely spaced, a little longer and gradually decreasing a little in length toward apex.

Head moderate in size, subtriangular in outline, about as long as wide, muzzle moderate in length; front broadly impressed, rather more strongly so each side of the median third, punctures moderate in size, rather dense and irregularly spaced; surface slightly vermiculato-reticulate against the eyes, densely rugoso-punctate on the occiput. Eyes large, prominent and strongly convex, setose, setae minute and sparse. Antennae moderately different in the sexes, rather slender and noticeably incrassate, extending to about basal third of the pronotum, slightly serrate from the fourth to the eighth joint.

Pronotum about a third wider than long, distinctly narrowed from basal third to apex, the latter moderately arcuate in circular arc; base broadly and moderately arcuate; sides rather strongly arcuate in basal half, thence almost straight and convergent to apex, serrulations small; angles rather strongly rounded, the basal distinctly so and continuing the curve of the sides and base; disk moderately convex from side to side, most so and declivous antero-laterally, densely indentato-punctate, reticulately so laterally.

Elytra oblong, base slightly emarginate and about equal to the greatest width of the pronotum, moderately convex, flattened a little on the dorsum, apex broadly and not strongly rounded; surface impressed at base just within the humeri, the latter rather tumid and moderately rounded; subrugoso-punctate, punctures coarser than on the pronotum and separated by a distance equal to one or two times their diameter.

Abdomen less than moderately convex, densely and finely punctate; pubescence finer and a little longer than on the upper surface.

Legs rather slender and moderate in length; femora not tumid and quite similar in the sexes.

Male.—More oblong and parallel. Antennae slightly stouter, second joint feebly obconic-oval, less than twice as long as wide, slightly narrowed at base; third obconic, about twice as long as wide and notably smallest in diameter; fourth obconic-triangular, about a half longer than wide at apex; fifth triangular, prominent anteriorly and about as long as wide, a little more so than the sixth and seventh, the latter two subequal in size and about as long as wide, thicker than the preceding joints; eighth a little more rounded in transverse section and about as long as wide; ninth a little the largest; eleventh obovate, truncate

at apex and feebly compressed distally, about a half longer than wide. Fifth ventral abdominal segment truncate and feebly sinuate at apex.

Female.—Larger and more oblong-oval, sides slightly arcuate. Antennae less stout, fifth joint smaller and less prominent anteriorly, other joints proportioned as in the male. Fifth ventral rather strongly rounded, but not broadly so, at apex.

Measurements.—Length (types), 3.1 to 3.8 mm.; width, 1 to 1.3 mm.

Holotype, male and *allotype*, female, in the author's collection. Paratypes in the collection of Mr. Chas. Liebeck. Four specimens studied: three males and one female.

Type locality.—Laurel, California. Collected in June.

Obsoletus is related to *variegatus* and *anacapensis* and is a larger and more robust species. In *variegatus* the pattern of elytral maculation is more or less distinct, the head oval in outline and the muzzle shorter; the antennae extend beyond the pronotal base, the head and pronotum being relatively shorter than in the two other species mentioned. *Anacapensis* is an insular species and more thickly clothed with cinereous pubescence, the elytral pattern is feebly developed, besides it is a more slender species.

Listropsis armatulus new species

Form oblong to slightly oblong-oval, elongate, moderately convex. Color black and moderately shining; antennae and femora piceous; tibiae and tarsi rufous. Surface with a very feeble metallic tinge.

Pubescence sparse, moderate in length, not conspicuous, recumbent and not intermixed with erect hairs; grayish to feebly flavate in color and of uniform structure throughout. Lateral pronotal fimbriae of moderate length, regular and rather close-set; elytral fimbriae slightly longer, not quite so close-set and very slightly longer toward base.

Head moderate in size, subtriangular, about as long as wide across the eyes, muzzle of moderate length; front broadly and feebly impressed, with a glabrous area behind the epistomal base, very sparsely punctate, punctures small; surface near the eyes and on the vertex rather finely rugulose, densely so on the occiput. Eyes moderately large, rather evenly and strongly convex, with very short setae at angles between the corneae. Antennae moderate in stoutness, feebly incrassate and slightly different in the sexes.

Pronotum about a fourth wider than long; apex quite truncate in moderate circular arc; base broadly and moderately arcuate, a little wider than the apex; sides rather evenly and moderately arcuate, slightly convergent anteriorly, margins not serrulate; angles rather broadly rounded, the basal more strongly so; disk a little more than moderately convex, slightly more strongly declivous antero-laterally; rather evenly and rather sparsely punctate, punctures not coarse and separated by a distance equal to about two or three times their diameter; surface smooth between the punctures in the central area, becoming more or less densely and finely rugulose in lateral third.

Elytra oblong, rather broadly emarginate at base, apex broadly rounded, sides parallel, humeri rather tumid and moderately rounded; disk moderately convex, slightly flattened in the central area, irregularly punctured, punctures a little coarser than on the pronotum and separated by a distance equal to one or two times their diameter, becoming slightly smaller toward apex; surface more or less obsoletely transversely rugose in basal two-thirds.

Abdomen not very convex, finely and abundantly punctate and minutely rugulose. Legs moderate in length and stoutness.

Male.—Slightly more oblong and parallel, head and prothorax a little larger. Antennae rather stout, second joint oval, a little longer than wide; third obconic and slightly more than twice as long as wide; fourth larger, rather triangular and less than twice as long as wide; fifth largest, triangular, a little longer than wide and more prominent anteriorly than the contiguous joints; sixth, seventh and eighth about as long as wide and subequal in size; ninth and tenth stouter, ninth about as long as wide, tenth slightly transverse; eleventh obtusely subfusiform, widest near the middle, about a half longer than wide and slightly compressed apically. Fifth ventral abdominal segment distinctly modified; sinuate at apex, adjacent surface rather deeply impressed and glabrous; pubescence slightly denser, somewhat coarser and blackish or brownish to base of segment in the median line.

Female.—Slightly stouter, sides a little more arcuate, head and pronotum rather smaller. Antennae less stout and a little longer, joints proportioned about the same, the fourth scarcely triangular. Fifth ventral rather broadly rounded at apex, surface slightly impressed at middle and there with a slight glabrous convexity.

Measurements.—Length (types), 3.2 to 3.6 mm.; width, 1.1 to 1.4 mm.

Holotype, male, and *allotype*, female, in the author's collection.

Paratypes in the collection of the author and that of Mr. Chas. Liebeck.

Armatulus is very distinct from *tinctus* Blaisdell. In the latter the fifth ventral abdominal segment is slightly modified. In one male of *armatulus* the edeagophore is protruded and is bispinous at apex, while in *Listrus* it is trispinous. In *armatulus* the spines are ventral and at least twice as long as in *Listrus*, while there are two ventral and one dorsal spine in the latter. In both species of *Listropsis* the pronotal punctuation is very sparse and the surface is finely rugulose in lateral third. In *tinctus*, the type of the genus, the pubescence is dual; in *armatulus* erect setae or hairs are absent, so that a dual pubescence is not a generic character and should be so considered. *Listropsis* is intermediate between *Listrus* and *Trichochrous*. In one male of *armatulus* at hand an anterior tibia is curiously deformed; it is short and terminates in two claws. The tibia and tarsus being abortive, differentiation has not taken place.

LIFE HISTORY STUDIES OF SOME CALIFORNIAN RHOPALOCERA (LEPIDOPTERA)

BY KARL R. COOLIDGE

Hollywood, California

The Life History of Hylephila phylaeus Drury (Hesperiidae)

Hylephila phylaeus is a very common butterfly in Southern California, ranging along the coast northwards nearly as far as San Francisco; and inland, in the San Joaquin Valley, to Sacramento. In view of its abundance it is rather odd that the late W. G. Wright did not include the species in his "Butterflies of the West Coast." Instead, Mr. Wright misidentified *phylaeus* as *brettoides*, stating that it is very local—to be found only in one small valley. Mr. Wright also gives rose as the food-plant. I have many times observed *phylaeus* females ovipositing on lawn grass and on Bermuda grass (*Cynodon dactylon* (L.) Pers.), and in a number of other instances eggs were observed to be placed on rocks and twigs, even in the middle of a paved street. Hence, Mr. Wright's observation of oviposition on rose can be attributed to gross maternal carelessness, and I could not induce *phylaeus* larvae to partake of fresh tender rose leaves.

About Los Angeles, *phylaeus* can be seen on the wing practically every day of the year, but is at its height in the late summer and hot fall months. With one sweep of a net over a lantana bush I once captured eighty-four specimens.

The young larvae escape by eating out irregular holes in the summits of their eggs, about .22 mm. in diameter, usually eating considerably of the remaining shell, often to the base. The usual type of nest is constructed, and the larvae, while sluggish during their earlier instars, became nervously active as they approached maturity. The periods were passed as follows:

Eggs laid, October 31. Hatched, November 17. Passed first molt, November 26. Passed second molt, December 7. Passed third molt, December 15. Passed fourth molt, December 22. Pupation, December 30.

The Egg.—Hemispherical, sharply flattened at the base, thence swelling out evenly to the greatest breadth in the middle of the lower two-thirds, and from there narrowing evenly to the summit. Surface of egg smooth to the naked eye, but under high magnification seen to be minutely punctate and with an exceedingly fine tracery of net-work. The micropyle in an obscure, scarcely depressed pit.

Color, very pale bluish green, glistening. Diameter of base, .66 mm.; greatest breadth, .70 mm., diameter of summit, .22 mm. Height, .52 mm.

First Instar.—Head, .46 mm. in diameter, globose, black, with a few short hairs, about .04 mm. in length, inserted in shallow punctures. The median suture rather deeply impressed. Ocelli and mouth parts black.

Body plump, nearly equal, but very slightly arched, tapering but slightly towards both extremities. The skin semi-transparent, allowing the internal organs to be seen in action. Dorsal shield brown-black, furnished with a transverse series of fine tapering hairs, about .1 mm. in length, slightly bent anteriorly. On thoracic segments two and three, two pairs of luteous corneous papillae, close together, one above the other, subdorsally; those of the anterior segment the largest, those of the following segment closer together. Spiracles circular, .02 mm. in diameter, castaneous-ringed. Four series of minute bristle-bearing papillae, as follows:

A subdorsal series, one in middle of anterior half of segment; a lateral series, one in middle of posterior half of segment; a substigmatal series, one a little before the middle; an infrastigmatal series, two to a segment, one anterior, one posterior. The bristles arising from these papillae, .04 mm. in height, black except the tips, which are enlarged into wine-glass bulbs, pellucid. The bristles erect, except those of the subdorsal row, which are inclined inwards.

Anal segment with two pairs of subdorsal papillae, which give rise to long, recurved, sharpened hairs, projecting anteriorly and closely appressed to body; the anterior of these hairs .20 mm. in length, with the posteriors but slightly smaller. In the larvae examined these appressed hairs were lost shortly after

birth. Also on anal segment, two sets of papillae which project smaller colorless hairs; a mediodorsal pair, the hairs .11 mm. in length, and a lateral pair, with the hairs slightly longer, .13 mm. These sets of hairs project posteriorly.

Color of body at birth, pale lemon yellow. Prolegs and ventral surface concolorous; legs yellow-brown. As the larvae feed, a more and more greenish tinge is assumed, and a faint dark green dorsal line develops.

Length, 1.30 mm. Width at first thoracic, .32 mm.; width at anal segment, .28 mm.

Second Instar.—Head, .84 mm. in diameter, black, shining, rugose, the median suture deep; only a few scattered weak white hairs, .04 mm. in length on the average. Collar brown-black, .52 mm. in width, with a fringe of colorless sharp hairs, .12 mm. in length.

Body rather heavily granulated, each segment with five rather conspicuous folds. Covered with numerous black papillae, .04 mm. in height, from which arise hairs, .025 mm. in length on the average. These hairs are black, expanded at their tips into broad, truncated, pellucid saucers, .01 mm. in diameter. Last segment with a fringe of long hairs, sharp and colorless, projecting posteriorly, the longest .24 mm. in length. A latero-dorsal series of naked, fuscous, lenticular disks, round, .02 mm. in diameter, and situated anteriorly, one to a segment in a row. A substigmatal series of similar disks, one to a segment on either side, in line with the latero-dorsal disks. Spiracles round, .024 mm. in diameter, brown ringed; spiracles of segment eight much above the line of the others, and crateriform.

Color of body rather bright lemon-yellow, but becoming more and more dark greenish, especially dorsally, as the larva feeds; and at the completion of the stage altered to a dirty pale yellowish brown. Prolegs and ventral surface concolorous with body; legs fuscous. A dorsal line of brown green, not prominent. A narrow, inconspicuous, substigmatal line, pale yellow-white, disappearing on anal segments.

Length, 3.36 mm. Width at first thoracic, .72 mm.; height at second thoracic, .76 mm.; width at anal segment, .68 mm.

Third Instar.—Head, 1.20 mm. in diameter, black, very roughly corrugated, with numerous fine, sharp, white hairs,

.05 mm. in length on the average. Collar brown-black, pallid anteriorly, 1.1 mm. in width, with its hairs .14 mm. in length. As the stage develops, two longitudinal reddish stripes, .1 mm. apart, appear on summit of head, terminating in a slight curve at a distance of .80 mm. from the anterior edge of head, where they are replaced by two diagonal similar stripes, forming a very regular V, that spread out to include the mouth parts.

The numerous papillae as before, brown, the hairs .05 mm. in length on the average, blunt, white tipped. The segmental creases prominent. The naked lenticles .04 mm. in diameter. Body finely granulated. Anal segment with a fringe of fine sharp hairs, the longest .42 mm. in length. Spiracles round, .05 mm. in diameter, with a fine brown ring.

Color of body sordid yellowish brown, becoming more and more solidly brown as the stage develops. A rather prominent dark dorsal line, .08 mm. in width. A brown substigmatal band, varying in prominence, and usually only a more or less disconnected series of brownish blotchings. Prolegs and ventral surface concolorous with body; legs black.

Length, 7.50 mm. Width at first thoracic, 1.14 mm.; height at second thoracic, 1.12 mm.; width at anal segment, .94 mm.

Fourth Instar.—Head, 1.60 mm. in diameter, very rugose, with the hairs .06 mm. in length on the average. The reddish brown stripes as in previous stage, but now much more pronounced. Collar brown-black, pallid anteriorly, 1.40 mm. in width, with its hairs .16 mm. in length.

Body papillae as before, with the arising hairs now concolorous, .06 mm. in length on the average. Spiracles .06 mm. in diameter, pallid, with a fine brown ring. Segmental incisures sharp. Lenticles as before, .06 mm. in diameter. Fringe of hairs on anal segment as before, the longest .46 mm. in length, and all now brown tinged.

Color of body a dirty yellowish brown. Prolegs and ventral surface concolorous; legs black. Dorsal and substigmatal stripes now prominent, brown.

Length, 12. mm. Width at first thoracic, 1.50 mm.; at anal segment, 1.10 mm.

Fifth Instar.—Head, 2.90 mm. in diameter, very rugose, black, with only a few scattered blunt hairs, colorless, .08 mm.

in length on the average. The reddish brown stripes of head very conspicuous. Collar brown-black, pallid anteriorly, 2.19 mm. in width.

Body papillae black, .03 mm. in diameter at base and of the same height, with the arising hairs .08 mm. in length, mostly black, a few being colorless. Long hairs of anal segment .56 mm. in length. Body finely granulated, with the segmental incisures sharp, dark brown. Lenticles as before, .08 mm. diameter. Spiracles oval, pallid, with a fine brown ring, .14 mm. in length.

Color of body dark gray-brown. Ventral surface and prolegs greenish yellow; legs black, shining. A prominent, even, dark brown dorsal line, .24 mm. in width. A broken but fairly prominent latero-dorsal line, and below this the ground color is lighter, with a hazy indication of a pale yellowish substigmatal band.

Length, 22. mm. Width at first thoracic, 2.54 mm.; height at third thoracic, 3. mm.; width at anal segment, 2. mm.

Pupa.—Color yellowish brown, varying considerably, sometimes inclining to reddish brown, and again to yellowish green, but not conspicuously green in any of the specimens examined. A prominent black dorsal line, extending from head case to posterior extremity, though sometimes more or less wanting and disconnected on the last several abdominal segments. Paralleling this line, on the thorax, two prominent black dashes, generally straight, but sometimes slightly incurved. These vary in density and width, but are always present and conspicuous, about 2.5 mm. in length on the average. On the abdominal segments dorsally, a series of black quadrate blotchings, running longitudinally, sometimes entirely absent and usually only weakly developed. Ventrally, the wing cases are of a livid hue, the veining inconspicuous.

Head case dorsally with a fine designing in black lines. Pupa thickly clothed with spiculiferous sharp hairs, of varying size but about .40 mm. in length on the average and .02 mm. in width at base. These arise from low reddish brown tubercles. On the head cases these hairs are collected into five distinct but rather weak groupings. Spiracles oval, .14 mm. in length,

pallid. Cremaster dark red, 1. mm. in width at base, sloping sharply to a point. Prothoracic spiracle prominent, dark reddish anteriorly, black ringed posteriorly. The free portion of the tongue extending to a length of 1.75 mm., reddish brown, spatulate.

Length, 15.5 mm. to 17.5 mm.; height of thorax, 4.5 mm.; height of abdomen beyond wing cases, 3.10 mm.

The Life History of Apodemia mormo virgulti Behr

Apodemia mormo virgulti is one of the common butterflies of Southern California. In the immediate vicinity of Los Angeles it is double brooded, the first flight appearing in March and April and the second, which is by far the greater in point of numbers, in August, continuing on the wing until about the first of November. Possibly in the foot-hills and higher mountains there is but one brood, a fall one.

The food plant is *Eriogonum*, wild buckwheat, and no doubt the larvae will feed on any of the numerous species. I have found them on *E. fasciculatum* Benth.; *E. fasciculatum foliolosum* Stokes, the form of the foot-hills and mesas; *E. fasciculatum porifolium* P., the common variety of the desert slopes; and on Mt. Wilson, at an elevation of four thousand feet, on *E. elongatum* Benth.

On October 6, 1918, four female *virgulti* were confined with some sprigs of buckwheat and by the ninth fourteen eggs had been laid, eleven on the leaves, tucked in the clusters, and three on the main stem. These eggs hatched in fourteen days, but though a few of the larvae nibbled at the fresh food placed before them, the others refused to feed. In moving, this batch of larvae was lost, leaving me with the impression that while eggs laid by adults of the second brood hatch in the fall, hibernation is passed by the young larvae.

On June 1, 1920, a confined female laid four eggs, which duly hatched June 6, the larvae escaping by eating out round holes, .50 mm. in diameter, in the summit of the eggs, not attempting to devour any more of it. These caterpillars attacked their sprigs of *Eriogonum* heartily, passing the first molt June 21. The second molt was accomplished July 6, the third July 18,

and the final one July 27. A few days following the last molt the larvae climbed to the top of their cages as though for pupation. Leaving town, I did not again observe them until early in October, when I found three to be dead. I offered fresh food to the fourth, but though it nibbled slightly, it then resumed its dormant condition. A few days later this last larva was deceased.

On February 20, 1921, in Mint Canyon, near Los Angeles, I found three larvae of *virgulti*, full-grown and in hibernation under stones. Bringing these home, I placed fresh *Eriogonum* before them, and the following day, perhaps prematurely aroused from their lethargy by the warmth of the room in which they were confined, they began to wander about, only one of them deigning to partake of their food, and by the end of that week all had suspended for pupation, the imagoes emerging March 17.

From this it is clear that the larvae of the first brood spend the winter full-grown, but whether the larvae of the second hibernate in the first instar, as my experience would seem to indicate, is a point open for investigation.

The Egg.—Turban-shaped, the base sharply flattened, the sides swelling out roundly. Surface covered with a raised white net-work, divided into fairly regular subcircular cells, .025 mm. in breadth; the cell walls about .015 mm. in thickness. From the center of the cells arise delicate septae, scarcely higher than the cell walls. From each angle of reticulation arises a white, stiff, rather sharp pointed filament, .025 mm. in height and .02 mm. in thickness at base. The micropyle in a rather deep, even, circular depression, with sides rather abrupt, and .20 mm. in diameter.

Color, a delicate pink, with the micropyle region a shade darker. To the naked eye, the raised white net-work gives a frosted appearance. As the embryo develops, the egg assumes a dark violet coloration.

Height, .58 mm. Diameter of base, .44 mm.; greatest breadth, .82 mm.

First Instar.—Subcylindrical, tapering but slightly posteriorly. Head dark brown, .40 mm. in width.

The usual subdorsal series of chitinous patches, dark ochraceous brown, .10 mm. in length. The hairs from these brown,

averaging .34 mm. in length, arcuate posteriorly and minutely spiculiferous. Those of the second thoracic segment sweeping anteriorly over the head. A substigmatal series of chitinous shields, .06 mm. in breadth, the hairs arising from these colorless, extending laterally, longer on the average than the subdorsal hairs, the longest being .44 mm. A single subdorsal series of minute annuli. Spiracles circular, dark ringed, .015 mm. in diameter.

Color of body ochraceous, with a pinkish tinge in certain lights. As the stage proceeds a more and more pinkish coloration is assumed, while at the completion of the instar the color is a deep solid dark violet. Prolegs and ventral surface concolorous with above; legs yellow brown, black tipped.

Length, 1.20 mm. Width at first thoracic, .35 mm.; at anal segment, .25 mm.

Second Instar.—Head dark gray-brown, shining, .52 mm. in diameter; clothed with numerous short colorless hairs.

The subdorsal chitinous patches, .12 mm. in width, black, with the radiating hairs black, straight, spiculiferous and pointed; the longest ones .56 mm. in length; the shorter ones .34 mm. The substigmatal patches ochraceous, .12 mm. in width, with the projecting hairs also sharp and spiculiferous; the upper hairs black; the lower, and those projecting laterally, colorless; the longest hairs .60 mm. in length, weaker than the subdorsal hairs, some of them curving roundly posteriorly. These substigmatal patches, as a whole, give the appearance of a disconnected stripe. The lateral patches, midway between subdorsals and substigmatals, situated anteriorly, smaller, .08 mm. in width, black, with their hairs black, but shorter than in the other series. First thoracic segment with a heavy fringe of colorless hairs sweeping out over the head. From the center of the subdorsal whorls of the third thoracic segment there projects a long colorless hair, 1.50 mm. in length, extending straight and laterally to an angle of about twenty degrees. Spiracles circular, black ringed, .03 mm. in diameter.

Color of body dark violet. Legs yellow-brown, black tipped; prolegs basally pink, terminated with yellow.

Length, 2.84 mm. Width at first thoracic, .56 mm.; height at first thoracic, .60 mm.; width at anal segment, .34 mm.

Third Instar.—Head dark brown, very roughly corrugated, with the median suture deep and wide. The head now a mass of spines, those of the upper portion mostly dark, the lower ones mainly colorless. These hairs straight and sharp, .36 mm. in length on the average, and .018 mm. in width at the base. Diameter of head, .90 mm.

Subdorsal chitinous patches black, .18 mm. in diameter, with a surrounding edge of ochraceous on the interior margin. The radiating hairs straight, sharp, .40 mm. in length, spiculiferous, dark brown. The substigmatal patches ochraceous, light brown at tips; their projecting hairs colorless, the longer ones 1. mm. in length, the shorter ones .30 mm. The lateral patches, .12 mm. in diameter, dark brown, their hairs dark brown; a roundish ochraceous patch below them. The subdorsal patches .10 mm. in height, and those of the thoracic segments project a long, colorless, wavy hair, extending up and laterally. Spiracles circular, black ringed, .04 mm. in diameter.

Color of body, pale violet. Ventral surface light reddish brown; prolegs light brown; legs yellow-brown, black tipped.

Length, 3.66 mm. Width at first thoracic, .82 mm.; at anal segment, .60 mm.

Fourth Instar.—Head roughly corrugated, dark brown, 1.24 mm. in diameter; as before, a mass of spines, the longer ones 1.60 mm. in length, and shorter ones to .40 mm.; and all are spiculiferous, with those above mostly brown, and those below pallid.

Subdorsal patches black, .24 mm. in diameter, edged interiorly with ochraceous; the radiating hairs stout, straight, pointed, the longest .48 mm. in length. These subdorsal patches, except on some of the abdominal ones, also project long, colorless, wavy hairs, 2. mm. in length, one from each whorl. The lateral patches .14 mm. in diameter, black, edged below with an ochraceous crescent. The substigmatal patches, .36 mm. in diameter and .10 mm. in height, conspicuously ochraceous but light brown at tips, where the hairs originate; as before, the upper hairs brown and the lower colorless; the longest .66 mm. in length, with others down to .40 mm. From the center of each whorl is projected a long, wavy, colorless hair, 1.84 mm. in length and .04 mm. in width at base, and prominently and heavily spiculiferous.

Color of body a pronounced pale violet. Ventral surface light reddish brown; prolegs reddish brown; legs yellow-brown, black tipped.

Length, 5. mm. Width at first thoracic, 1.18 mm.; at anal segment, .64 mm.

Fifth Instar.—Head, 1.80 mm. in diameter, black, but almost entirely obscured by the mass of spines it bears. The long, spiculiferous, pallid, wavy sharp hairs of head, 2.5 mm. in length; the shorter, straight, dark brown hairs, .52 mm. in length.

Subdorsal patches black, .40 mm. in width, edged interiorly with ochraceous; the radiating hairs straight, stout, pointed, black, the longest .80 mm. in length. The colorless, wavy hairs arising from these patches, one to a whorl, 2.80 mm. in length. Similar hairs, and of the same length, projected from the substigmatal patches. Lateral patches black, .24 mm. in width, edged below with an ochraceous crescent. Substigmatal patches ochraceous, fuscous at tips where the hairs originate, and .44 mm. in diameter; as before, the upper hairs brown, the lower colorless; the longest hairs 1.20 mm. in length, shorter ones .50 mm. First thoracic segment with a number of long colorless hairs extending out over the head.

Color of body bright violet. Ventral surface light violet; legs red-brown, fuscous tipped; prolegs pale brick red.

Length, 12 mm. Width at first thoracic, 1.60 mm.; at anal segment, 1.40 mm.

Pupa.—Short and plump. The ventral surface flattened, but with a slight sinuous curve. The head bent down entirely on the ventral surface. The anterior extremity, formed by the prothorax, broad and well rounded. The abdomen subconic, tapering evenly to posterior end.

Surface of body minutely corrugated. Clothed dorsally with long filament-like, colorless, minutely spiculiferous, wavy hairs; these are especially prominent on the anterior extremity of the prothorax. The ventral surface quite free from these hairs, which vary slightly in size, some being as long as .30 mm., others as short as .14 mm. The cremaster distinct, subtriangular, truncated apically, .44 mm. in width. Scattered over the cremaster a grouping of heavy hooklets, orange-brown in color,

enlarged at the summit into mushroom-like saucers. These hooklets .16 mm. in height, .01 mm. in width at base, with the apical cap .04 mm. in diameter. Spiracles oval, .12 mm. in length, prominent, and seated on irregular patches of orange-brown, which to the naked eye appear as a fairly prominent series of spots.

Color of abdomen, black brown. Thorax and wing-cases dull smoky brown, but the former has irregular blotchings of black. Two orange spots on highest dorsal prominence of prothorax.

Length, 13. mm. Greatest breadth of abdomen, 5. mm.; greatest breadth of prothorax, 4.5 mm. Greatest height of prothorax, 3.75 mm.; greatest height of abdomen, 4.80 mm.

Suspended at anal extremity with a strong button of silk, and held loosely in place by a median girdle; not closely appressed to surface upon which pupation takes place.

The Life History of Callophrys dumetorum Boisduval (Lycaenidae)

Drs. Barnes and Benjamin have recently given to the form of *Callophrys dumetorum* occurring in Southern California the name *perplexa*, agreeing with an opinion I have long held that our race here is quite distinct from the typical insect, which, as far as I can learn, is like *Plebeius pheres* and *Glaucopsyche xerces* in being strictly confined to its type locality, San Francisco. Moreover, the larva of *dumetorum dumetorum*, as described by F. X. Williams,[1] presents some phases which I have not observed in Southern Californian examples, of which I have observed hundreds.

In the immediate environments of Los Angeles, *dumetorum perplexa* is one of our earliest butterflies, issuing in late February, but as a rule is not on the wing in considerable numbers until about the middle of March, with fresh specimens appearing until nearly the end of April. Around Los Angeles I have found only species of *Fabaceae* serving as food-plants, particularly the Deer-weed, *Syrmatium glabrum* (Torr.) Greene, and on several species of *Hosackia*, *lathyroides* D. & H. and *strigosa* Nutt. At San Francisco, Williams lists the food-plant as *Eriogonum*

[1] Ent. News, xxi, p. 36, (1910).

latifolium Smith, *Polygonaceae,* and on the Colorado Desert I have observed females depositing their eggs on *E. fasciculatum foliolosum* (Nutt.) Stokes. The numerous species of *Eriogonum,* wild buckwheat, in Southern California, along the coastal region at least, do not come into bloom until about July, while *Hosackia* and *Syrmatium* are some of our earliest plants to spring into flower. Larvae from *Syrmatium,* when transferred to *Eriogonum,* attack it greedily without a second's hesitation.

The eggs are laid upon the sepals of the just unfolding buds, rarely on the leaves, and the females are more particular in their ovipositing than any species of butterfly with which I am acquainted. I have watched females fuss around for a half an hour or more before a satisfactory place for an egg could be found. Hatching, the young larvae attack the tender buds, boring into them as per the usual lycaenid tactics. Only rarely have I found them on the leaves.

There is but the one brood a year, and hibernation is passed in the pupal state.

Eggs laid March 30, hatched April 8. Passed first molt, April 16. Passed second molt, April 23. Passed third molt, April 26. Pupated, May 2.

The Egg.—In shape, a depressed echinoid. The base sharply flattened, .42 mm. in diameter; from base rounding out broadly to the greatest diameter, .58 mm., and as evenly rounding to the truncated summit, which is of the same diameter as the base. Centrally, the apex is infundibuliform, the sides sloping rather swiftly to the micropylar region, which is obscure and composed of a few oval cells surrounding a central circular cell, all very weakly defined.

Adorned with with the usual theclid system of raised white net-work, forming cells, which are not disposed in any regular manner. On the sides they are mostly subtriangular, though some are quadrate, and about .02 mm. in their greatest diameter. Apically, pentagonal cells seem to prevail. The cells have their walls rather sharp, even, .005 mm. in thickness. Where the walls meet at the angles of the cells low abrupt buttresses are formed, .01 mm. in diameter, and .02 mm. in height. The surfaces of the cells glistening, extremely minutely punctate.

Color of egg a deep green. Height, .36 mm.

First Instar.—Head very pale brown, smooth, shining, .20 mm. in diameter. First thoracic segment with a distinct bluish tinge and with some short, weak, spiculiferous white hairs, averaging .10 mm. in length, that project anteriorly.

Body with a latero-dorsal series of papillae, centrally situated, one to a segment on either side; these are .02 mm. in height, .01 mm. in diameter at base, and fuscous at their tips. Outside these, and slightly posterior, another set of latero-dorsal papillae, also one to a segment on either side. These are smaller, .01 mm. in height and of about the same diameter basally, and also fuscous tipped. Both series give rise to long, sweeping, prominently spiculiferous, colorless curving hairs, directed posteriorly. Those issuing from the larger inner tubercles are .28 mm. in length; those of the smaller outer papillae, .14 mm., and more recumbent.

Substigmatally, three more papillae to a segment on either side. The one most centrally located gives rise to a long spiculiferous colorless hair, .24 mm. in length. The one from the lower anteriorly placed papilla is .12 mm. in length. The other papillae are placed above, slightly in back of the middle, and the arising hairs are but .08 mm. long.

A lateral series of naked, brown, hemispherical lenticles, situated on the first anterior fourth of the segment and in diameter .02 mm. These lenticles absent on the first thoracic, and on the abdominal segment preceding the fused anal segments there is an additional one, placed posteriorly and a little outside the other but connected with it; this is about one-third smaller than the normal ones. On the last two fused anal segments there are more such lenticles; an additional one, subequal, placed a little posteriorly and outside, and not connected with the normal ones. And a much smaller pair, one on either side, still more posteriorly placed in the subdorsal region.

The circular coriaceous depression of the last two abdominal segments .09 mm. in diameter. The coriaceous shield of the first thoracic .16 mm. in width. Spiracles round, .005 mm. in diameter, with a rather heavy ringing of fuscous.

Color of body a very pale lemon yellow, with a perceptible whitish sheen. But, as they feed, the larvae assume more and

more a tingeing of orange brown. Ventral surface bright lemon-yellow. Prolegs concolorous with ventral surface; legs opaque, very slightly tinged with fuscous.

Length at birth, .96 mm. Width at first thoracic segment, .24 mm.; width at last abdominal segment, .16 mm.

Second Instar.—Head piceous, smooth, shining, .40 mm. in width. The elongated neck bright greenish yellow.

The body bristling with numerous quite equally distributed coarse sharp hairs. These hairs varying in length, some being as long as .30 mm., with others as short as .10 mm. Dorsally and laterally, the hairs are tinged with fuscous, but along the substigmatal fold they are colorless, and all are minutely but rather heavily spiculiferous. The papillae from which they arise .02 mm. in height and of the same diameter basally. They are pallid basally, but at the point where the hairs arise they are distinctly brown. Spiracles round, pallid, .02 mm. in diameter, with a fine fuscous ring.

Color of body varying, in different individuals, from a pale green to a light yellowish green. As they feed, the larvae develop traces of a bright yellow subdorsal band, in the form of irregular and not distinctly outlined blotchings. The substigmatal bands, so conspicuous in the following instars, also become faintly indicated. Ventral surface and prolegs pale green. Legs pale yellow-brown, shining.

Length, 3. mm. Width at first thoracic segment, .66 mm.; at anal segment, .50 mm.

Third Instar.—Head dark chestnut brown, smooth, shining, .70 mm. in width; the ocellar field black. The coriaceous shield of first thoracic pale gray, .40 mm. in length.

The body, as in previous stage, bristling with numerous short straight, sharp coarse hairs; the largest of these .34 mm. in length, but the average is .18 mm. These hairs arise from dark brown tubercles, .02 mm. in diameter and height. The hairs minutely spiculiferous, and while some are colorless, the majority are slightly tinged with brown. Spiracles round, pallid, .03 mm. in diameter, with a fine fuscous ring.

Color of body a rather dark grass green. On either side of dorsal line a yellowish stripe, irregular, not sharply defined.

Along substigmatal fold an indistinct pure white stripe. As the stage progresses the subdorsal yellowish bands, which begin in the third thoracic segment and fade out on the last few anal segments, become more and more prominent, and the substigmatal white stripe becomes conspicuously distinct. In rare cases the subdorsal stripes, instead of being bright yellow, are concolorous with the substigmatals. Ventral surface and prolegs concolorous with body above. Legs sub-hyaline, very pale brown, shining, darker at tips.

Length, 7. mm. Width at first thoracic segment, 1.30 mm.; at anal segment, 1. mm.

Fourth Instar.—Head yellow-brown, smooth, shining, 1.20 mm. in width. A few scattered, weak, short, colorless hairs along sides of head, .06 mm. in length; and a half a dozen or so longer ones, .1 mm., along the lower frontal edge. Mouth parts pale reddish brown; eyes white, set in a black field.

The body slug-shaped, stout, well ridged, subdorsally rather strongly concave, but depressed posteriorly; the segmental incisions deep and prominent. As before, bristling with numerous, short, straight, sharp coarse hairs, spiculiferous, slightly brown tinged, and with the tips prominently fuscous. A few of these hairs are as long as .50 mm., but the average is about .24 mm. Spiracles pallid, .1 mm. in diameter, with a fine fuscous ring. Cervical shield of first thoracic subquadrate, in color varying from a gray-white to rosaceous, and with a few scattered hairs.

Coloration of body varying considerably. In some examples the ground color is bright green, with the dorsal line a shade deeper. The yellow subdorsal stripes well indicated, beginning on second thoracic and fading out on last several abdominal segments. The substigmatal pure white stripe clearly defined and conspicuous. In some examples the yellow subdorsal bands are more or less disconnected, and appear as conspicuous crenate dashes rather than a continuous band. In one example the subdorsals and substigmatals were both very feebly developed. As the stage proceeds the white substigmatal bands become more or less tinged with bright yellow, sometimes completely obscuring the white. Finally, as the larvae finish feeding and

seek a location for pupating, the ground color becomes a sordid dull greenish, and the subdorsals and substigmatals become a brilliant and conspicuous pink.

Other phases are described by Williams (*ante*) as being "usually rather pale bluish green or dull translucent pale grayish green" with "The ridge on either side of the dorsum topped with a coral red blotch (sometimes partially obsolete), which is enclosed by the whitish or pale grayish white, broken ridge stripe, a part of which also runs through this blotch dividing it into the more conspicuous inner and the more obscure outer portion. Again, other larvae have "oblique sublateral, dark green dashes, plainest on the anterior portion of the segments and sometimes obsolete on their latter half or more" and mentions that in some instances the substigmatal band is bordered both above and below with purple. Another phase quoted is rose color, in one specimen almost wholly coral red and rose and light grayish green ventrad. Ventral surface and prolegs concolorous with ground color of body above. Legs pale yellow-brown, shining, darker at the tips.

Length at beginning of instar, 8. mm.; at maturity, 17. mm. Width at first thoracic segment, 3.50 mm.; at anal segment, 2.10 mm.

Pupa.—Stout and broad, the abdomen a little broader than high, well rounded, sloping abruptly posteriorly at last several segments. In color varying from a deep brown to black, usually quite uniform throughout, some individuals considerably mottled with a lighter shade of brown.

The surface roughened by a net-work of raised dark brown lines, not arranged in any regular system and for the most part disconnected. Profusely scattered over the body many roundish black papillae of varying sizes, some but .02 mm. in diameter, others up to .04 mm. These project short, stout, pointed and roughly and heavily spiculiferous translucent brown hairs, of varying lengths, from .06 mm. to .30 mm. Stigmata brown, with a pale yellowish bordering.

Length, 10. to 11. mm. Greatest breadth of abdomen, 5.50 mm.; greatest breadth of thorax, 4.10 mm. Greatest height of abdomen, 4.75 mm.; greatest height of thorax, 3.65 mm.

Pupation occurs in debris and under stones about the base of the food-plants, the pupa being either free or suspended by a very weak girdle.

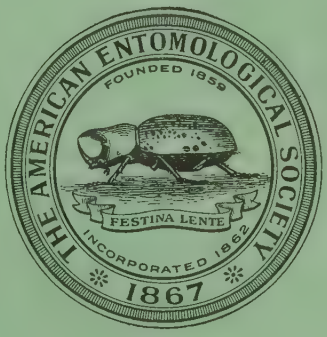
VOLUME L NUMBER 1

MARCH, 1924

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY



PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FIVE DOLLARS PER VOLUME

THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.

PRESIDENT
Henry Skinner

VICE-PRESIDENT
James A. G. Rehn

CORRESPONDING SECRETARY
Morgan Hebard

RECORDING SECRETARY
R. C. Williams, Jr.

TREASURER
Ezra T. Cresson

PUBLICATION COMMITTEE
James A. G. Rehn
Editor
Ezra T. Cresson
Philip P. Calvert

FINANCE COMMITTEE
Morgan Hebard
Chairman
D. M. Castle
James A. G. Rehn

PROPERTY COMMITTEE
Ezra T. Cresson, Jr.
Librarian and *Custodian*
Morgan Hebard
Philip Laurent

Meetings held (alternately with those of the Entomological Section of The Academy of Natural Sciences of Philadelphia) on the fourth Thursday of September, October, November, January, February, March, April and May, and on the second Monday of December (annual meeting). The offices, meeting-room, library and collections of the Society are in the Entomological Department of The Academy of Natural Sciences of Philadelphia, Logan Square.

SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of the Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of the American Entomological Society, volumes I–IV, out of print and cannot be supplied; V–X, $5.00 per volume; XI–XLVI, $4.00 per volume; XLVII-L, $5.00 per volume. Published in annual volumes of quarterly parts.

The Practical Entomologist, volumes I–II, 1865–1867. Price, $1.00 for the two volumes.

Memoirs of the American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50; number 3, 1919, price $1.50; number 4, 1920, price $2.50. Published irregularly.

Entomological News, volumes I–XXXV. Price $2.50 per volume. Published in conjunction with the Entomological Section of The Academy of Natural Sciences of Philadelphia.

Various irregular, non-serial publications have been issued, which may be found in our price lists under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History
American Museum of Natural History
Smithsonian Institution
Field Museum of Natural History
California Academy of Sciences
Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
PUBLICATION DEPARTMENT,
The Academy of Natural Sciences of Philadelphia
Logan Square.

CONTENTS

The Generic Characters and the Species of Philogenia Selys (Odonata; Agrionaidae). By Philip P. Calvert 1
(Issued May 29, 1924)

On the Male Genitalia of the Hesperiidae of North America. Paper IV. By Henry Skinner and R. C. Williams, Jr. 57
(Issued June 16, 1924)

VOLUME L NUMBER 2

JUNE, 1924

IMP. BUR.
SEP. 1924
ENTOM.

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FIVE DOLLARS PER VOLUME

THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.

PRESIDENT
Henry Skinner

VICE-PRESIDENT
James A. G. Rehn

CORRESPONDING SECRETARY
Morgan Hebard

RECORDING SECRETARY
R. C. Williams, Jr.

TREASURER
Ezra T. Cresson

PUBLICATION COMMITTEE
James A. G. Rehn
Editor
Ezra T. Cresson
Philip P. Calvert

FINANCE COMMITTEE
Morgan Hebard
Chairman
D. M. Castle
James A. G. Rehn

PROPERTY COMMITTEE
Ezra T. Cresson, Jr.
Librarian and *Custodian*
Morgan Hebard
Philip Laurent

Meetings held (alternately with those of the Entomological Section of The Academy of Natural Sciences of Philadelphia) on the fourth Thursday of September, October, November, January, February, March, April and May, and on the second Monday of December (annual meeting). The offices, meeting-room, library and collections of the Society are in the Entomological Department of The Academy of Natural Sciences of Philadelphia, Logan Square.

SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of the Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of the American Entomological Society, volumes I–IV, out of print and cannot be supplied; V–X, $5.00 per volume; XI–XLVI, $4.00 per volume; XLVII-L, $5.00 per volume. Published in annual volumes of quarterly parts.

The Practical Entomologist, volumes I–II, 1865–1867. Price, $1.00 for the two volumes.

Memoirs of the American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50; number 3, 1919, price $1.50; number 4, 1920, price $2.50. Published irregularly.

Entomological News, volumes I–XXXV. Price $2.50 per volume. Published in conjunction with the Entomological Section of The Academy of Natural Sciences of Philadelphia.

Various irregular, non-serial publications have been issued, which may be found in our price lists under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History
American Museum of Natural History
Smithsonian Institution
Field Museum of Natural History
California Academy of Sciences
Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
PUBLICATION DEPARTMENT,
The Academy of Natural Sciences of Philadelphia
Logan Square.

CONTENTS

Studies in the Acrididae of Panama (Orthoptera). By Morgan Hebard 75
(Issued July 21, 1924)

On the Male Genitalia of the Hesperiidae of North America. Paper V. By Henry Skinner and R. C. Williams, Jr. 141
(Issued July 21, 1924)

E&A

VOLUME L NUMBER 3

SEPTEMBER, 1924

IMP. DUE
LOND
ENTOM.

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FIVE DOLLARS PER VOLUME

THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.

PRESIDENT
Henry Skinner

VICE-PRESIDENT
James A. G. Rehn

CORRESPONDING SECRETARY
Morgan Hebard

RECORDING SECRETARY
R. C. Williams, Jr.

TREASURER
Ezra T. Cresson

PUBLICATION COMMITTEE	FINANCE COMMITTEE	PROPERTY COMMITTEE
James A. G. Rehn	Morgan Hebard	Ezra T. Cresson, Jr.
Editor	*Chairman*	*Librarian* and *Custodian*
Ezra T. Cresson	D. M. Castle	Morgan Hebard
Philip P. Calvert	James A. G. Rehn	Philip Laurent

Meetings held (alternately with those of the Entomological Section of The Academy of Natural Sciences of Philadelphia) on the fourth Thursday of September, October, November, January, February, March, April and May, and on the second Monday of December (annual meeting). The offices, meeting-room, library and collections of the Society are in the Entomological Department of The Academy of Natural Sciences of Philadelphia, Logan Square.

SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of the Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of the American Entomological Society, volumes I–IV, out of print and cannot be supplied; V–X, $5.00 per volume; XI–XLVI, $4.00 per volume; XLVII-L, $5.00 per volume. Published in annual volumes of quarterly parts.

The Practical Entomologist, volumes I–II, 1865–1867. Price, $1.00 for the two volumes.

Memoirs of the American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50; number 3, 1919, price $1.50; number 4, 1920, price $2.50. Published irregularly.

Entomological News, volumes I–XXXV. Price $2.50 per volume. Published in conjunction with the Entomological Section of The Academy of Natural Sciences of Philadelphia.

Various irregular, non-serial publications have been issued, which may be found in our price lists under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History	Field Museum of Natural History
American Museum of Natural History	California Academy of Sciences
Smithsonian Institution	Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
PUBLICATION DEPARTMENT,
The Academy of Natural Sciences of Philadelphia
Logan Square.

CONTENTS

The Group Scyllinae (Orthoptera, Acrididae, Acridinae) as Found in North America, with Records and Data on its Occurrence in the United States. By Morgan Hebard 157

(Issued September 10, 1924)

Observations and Experiments on the Dispersion of the Convergent Lady-Beetle (Hippodamia convergens Guérin) in California. By W. M. Davidson 163

(Issued September 10, 1924)

On the Male Genitalia of the Hesperiidae of North America. Paper VI. By Henry Skinner and R. C. Williams, Jr. 177

(Issued September 10, 1924)

Studies in Japanese Acrididae (Orthoptera). By Morgan Hebard 209

(Issued September 10, 1924)

Studies in the Dipterous Family Ortalidae, with Descriptions of New Species, mostly from North America. By E. T. Cresson, Jr. 225

(Issued September 10, 1924)

The Nearctic Rhagoveliae (Heteroptera; Veliidae). By J. R. de la Torre Bueno 243

(Issued September 10, 1924)

VOLUME L

NUMBER 4

DECEMBER, 1924

IMP. DIV. ENTOM.

TRANSACTIONS

OF THE

AMERICAN ENTOMOLOGICAL SOCIETY

PUBLISHED BY THE AMERICAN ENTOMOLOGICAL SOCIETY AT THE ACADEMY OF NATURAL SCIENCES

PHILADELPHIA

SUBSCRIPTION PRICE FIVE DOLLARS PER VOLUME

THE AMERICAN ENTOMOLOGICAL SOCIETY

PHILADELPHIA

Founded 1859 Incorporated 1862

Organized as "The Entomological Society of Philadelphia," the present title was adopted February 11, 1867.

PRESIDENT
Henry Skinner

VICE-PRESIDENT
James A. G. Rehn

CORRESPONDING SECRETARY
Morgan Hebard

RECORDING SECRETARY
R. C. Williams, Jr.

TREASURER
Ezra T. Cresson

PUBLICATION COMMITTEE	FINANCE COMMITTEE	PROPERTY COMMITTEE
James A. G. Rehn, *Editor*	Morgan Hebard, *Chairman*	Ezra T. Cresson, Jr., *Librarian* and *Custodian*
Ezra T. Cresson	D. M. Castle	Morgan Hebard
Philip P. Calvert	James A. G. Rehn	Philip Laurent

Meetings held on the fourth Thursday of September, October, November, December, January, February, March, April and May, except on holidays, when the meeting is on the preceding Thursday. The offices, meeting-room, library and collections of the Society are in the Entomological Department of The Academy of Natural Sciences of Philadelphia, Logan Square.

SERIAL PUBLICATIONS OF THE SOCIETY

Proceedings of the Entomological Society of Philadelphia, volumes I–VI, 1861–1867. Out of print and cannot be supplied.

Transactions of the American Entomological Society, volumes I–IV, out of print and cannot be supplied; V–X, $5.00 per volume; XI–XLVI, $4.00 per volume; XLVII–LI, $5.00 per volume. Published in annual volumes of quarterly parts.

The Practical Entomologist, volumes I–II, 1865–1867. Price, $1.00 for the two volumes

Memoirs of the American Entomological Society, number 1, 1916, price $2.00; number 2, 1917, price $4.50; number 3, 1919, price $1.50; number 4, 1920, price $2.50. Published irregularly.

Entomological News, volumes I–XXXVI. Price $2.50 per volume.

Various irregular, non-serial publications have been issued, which may be found in our price lists under their respective authors.

To establish the date of issue, each paper, as soon as completed, is placed on sale and a copy of it is mailed to each of the following institutions, with a request that it be placed in their library for reference.

Boston Society of Natural History	Field Museum of Natural History
American Museum of Natural History	California Academy of Sciences
Smithsonian Institution	Entomological Society of Ontario

Separates of papers published in the Proceedings and Transactions, if not out of print, can be supplied at prices given in our price lists, which are sent upon application, stating order or orders desired. The Society has also inaugurated a system of subscription to papers published by it on individual orders, which arrangement is of material benefit to the student who desires promptly the literature on any special group, but who does not desire to subscribe to entire volumes of the Transactions. A method of notification of the appearance in its publications of papers relating to individual orders or subjects has been developed by the Society. Information concerning these arrangements supplied upon application.

In sending subscriptions or in making inquiries relative to publications, address:

THE AMERICAN ENTOMOLOGICAL SOCIETY,
PUBLICATION DEPARTMENT,
The Academy of Natural Sciences of Philadelphia
Logan Square.

CONTENTS

A Revision of the Genus Taeniopoda (Orthoptera, Acrididae, Cyrtacanthacrinae). By Morgan Hebard . . 253
(Issued January 6, 1925.)

The Dipterous Genus Syntormon in North America (Dolichopodidae). By M. C. Van Duzee 275
(Issued January 6, 1925.)

A Tabular Account of the Differences between the Earlier Instars of Pantala flavescens (Odonata: Libellulidae). By Laura Lamb 289
(Issued January 12, 1925.)

Studies in the Melyridae (Coleoptera). Number Four. By Frank E. Blaisdell, Sr. 313
(Issued January 12, 1925.)

Life History Studies of Some Californian Rhopalocera (Lepidoptera). By Karl R. Coolidge 319
(Issued January 12, 1925.)